

**ACTINOBACILLUS SUIIS INFECTIONS IN ALBERTA SWINE,
1973-75: PATHOLOGY AND BACTERIOLOGY**

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INTRODUCTION

PREVIOUS reports of *Actinobacillus suis* infections in swine described "pyemia" or arthritis in piglets ranging in age from two days to three months (6). The organism was recovered from the blood of swine which had been killed by atomic blast and from a joint of an irradiated pig (7). It has been reported as an occasional isolate from arthritic joints of swine (1).

The infection was recognized at the Edmonton laboratory during 1973. The following report summarizes clinical, pathological and bacteriological findings encountered in seven submissions from which *A. suis* was isolated at the Edmonton Veterinary diagnostic laboratory in 1973-75.

SUMMARY OF CASES

Case #1

A. suis and a moderate growth of mixed coliforms considered to be contaminants were isolated from a vaginal swab taken from a four year old sow affected by pyometra. The sow had earlier delivered two dead piglets 16 days following its anticipated parturition date. The sow was subsequently submitted for postmortem examination. A macerated fetus, purulent metritis and cystitis were found at necropsy. *Corynebacterium pyogenes* was isolated from the uterus and piglet at necropsy.

Case #2

A. suis was isolated from the umbilicus in scant growth and in heavy growth from the atlanto-occipital joint of one of three seven to ten day old piglets affected with omphalophlebitis, meningitis and severe septic arth-

ritis. Scant coliforms were isolated from the umbilicus and a few alpha hemolytic streptococci thought to be fecal streptococci from the atlanto-occipital joint.

Case #3

One dead piglet was submitted from a two week old litter of seven in which three had died and one was ill. Clinical signs as described by the submitting veterinarian were listlessness and dyspnea. Gross postmortem findings included consolidation of the apical and cardiac lobes of the lung, fibrinous pericarditis and pleuritis. Increased numbers of alveolar macrophages and diffuse alveolar thickening were noted during histological examinations. *A. suis* was isolated from a pooled sample of lung, spleen, kidney, liver and gall bladder in moderate pure culture while a few coliform colonies were isolated from the lung.

Case #4

A dead two week old piglet was submitted. There were 20 piglets sick on the premises and two had died. Some emphysema and a few small areas of atelectasis were noted in the lungs and the small intestine was congested. *A. suis* was isolated from a pool made from the heart, liver, lung and kidney. A non-hemolytic coliform in scant growth, considered to be a sampling contaminant, was isolated from the same pool.

Case #5

The subject was a two month old piglet, one of four which had died with signs of acute respiratory distress. Necropsy findings as described by the veterinarian included pleuritis, pneumonia, focal hepatitis and focal hemorrhages of the myocardium. *A. suis* was isolated in heavy pure culture from a pool of the spleen, liver and lung.

On histopathological examination, subacute pleuritis and focal alveolar collections of mono-

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nuclear inflammatory cells with extensive alveolar edema were present in the lung. Congestion was present in the heart and liver.

Case #6

Four dead, two week old piglets from a litter of ten animals were submitted. Clinical signs had not been observed prior to death. The owner reported that another sow had lost three piglets in a similar manner during the previous week but postmortem examinations were not performed.

At necropsy, similar gross lesions were observed in each piglet. These consisted of pallor of internal organs, edematous lungs with extensive subpleural ecchymoses, subepicardial petechiae, subserosal petechiae on the stomach and intestines, and subcapsular renal petechiae. In the lungs of all pigs, numerous areas of hemorrhage were observed while a few strands of fibrin were found in the abdominal cavities of these pigs.

On histopathological examination of the lungs, focal hemorrhages, alveolar and interlobular edema and numerous bacterial colonies were observed (Figure 1). In the liver, there was focal necrosis surrounding bacterial colonies (Figure 2) but no cellular reaction was evident. Congestion and petechiae were noted in the kidney. *A. suis* was isolated in heavy pure growth from the lung, spleen and heart of two piglets. It was isolated in heavy pure culture from the lung and from a pool of the heart, liver and spleen of a third piglet.

Case #7

The submission consisted of three dead 12 week old pigs. Advanced fibrinous pneumonia was noticed in all three animals. *Hemophilus parahemolyticus* was isolated from the liver, spleen and lung of the first animal and *A. suis* was isolated from the lung and spleen of the same animal. *H. parahemolyticus* was isolated from the lung, spleen, kidney and liver of the second animal and from the lung and spleen of the third animal.

GENERAL CHARACTERISTICS OF THE ISOLATES

Colony and Growth Characteristics

Growth occurred aerobically at 37°C in 24 hours on sheep blood agar and with one exception no growth occurred on MacConkey's or Salmonella-Shigella agar.¹ Initially, colonies were raised, tiny, almost transparent with a narrow zone of beta hemolysis and adhered to the surface of the media. After 48 hours, col-

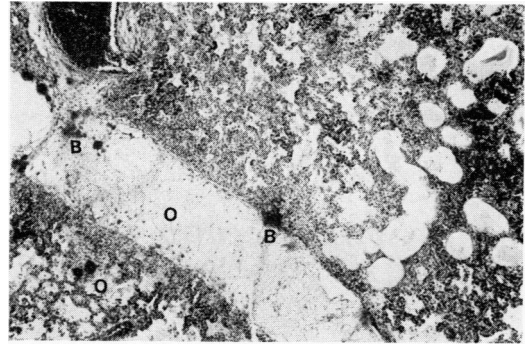


FIGURE 1. Lung. Focal hemorrhage, alveolar and interlobular edema (O) and bacterial colonies (B). (Case #6). H & E. $\times 27$.

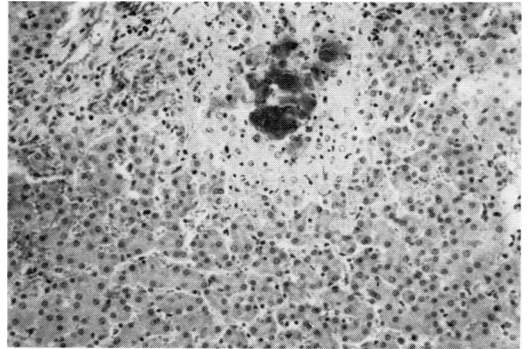


FIGURE 2. Liver. Focal necrosis surrounding bacterial colonies. (Case #6). H & E. $\times 70$.

onies were greatly increased in size with a wide zone of hemolysis. After three to four days incubation, colonies had a definite raised center with a flattened periphery that had somewhat irregular edges (smooth and slightly rough variants were noted). In serum broth, the broth was clear with a heavy adherent sediment.

One isolate (from Case #6) differed from the other isolates in the following aspects: 1) It appeared to be a rougher colony type and remained very rough and adherent to media after several weeks of subculturing and 2) it grew fairly well on MacConkey's agar.

Morphological Characteristics

A. suis was a gram negative bacillus varying from short rods to coccobacilli, some in chains and some longer pleomorphic filaments with uneven staining property.

Biochemical Characteristics

Table I summarizes some of the biochemical characteristics of *A. suis*. One isolate (from Case #6) produced hydrogen sulfide (H_2S)

¹Difco Laboratories, Detroit, Michigan.

TABLE I
SOME BIOCHEMICAL
CHARACTERISTICS OF
A. suis ISOLATES

Urease Production ^a	+
Nitrate Reduction ^b	+
Indole Production (2)	-
Sugar Reactions	
Acid Production ^c	
Lactose	++
Glucose	++
Maltose	++
Sucrose	+
Dulcitol	-
Mannitol	-
H ₂ S Production	-

^aBacto-urea broth concentrate, Difco Laboratories, Detroit, Michigan.

^bBacto-nitrate test strips, Bacto.

^cReference 4 (with the addition of 10% sheep serum and using Andrade's indicator.

using lead acetate strips² but did not produce H₂S on Kligler's iron agar.³ Unfortunately, the lead acetate strip method for detecting H₂S production was not used on the other porcine isolates.

Antibiotic Sensitivities

The organisms isolated were sensitive to a wide variety of antibiotics. One isolate was resistant to tetracyclines and dihydrostreptomycin. Two isolates (both from the same submission) were resistant to chloramphenicol, cloxacillin and lincomycin.

DISCUSSION

Actinobacillosis in swine usually has not been recognized as a distinct disease entity (7). However, there are reports of naturally occurring infections (particularly in suckling and weanling pigs) with *Bacillus polymorphus suis* (3). Later work indicated that this organism differed from *Bacterium viscosum equi* syn. *A. equuli* in its hemolytic and serological properties, in its failure to form adherent colonies and in its virulence for domestic and experimental laboratory animals (5). More recently, actinobacillosis in piglets has been described which was characterized by arthritis and by pyemic lesions in the kidney, lung and heart (6).

Cultural and biochemical characteristics vary widely between *Actinobacillus* species

²Hydrogen sulfide test strips, Difco Laboratories, Detroit, Michigan.

³Difco Laboratories, Detroit, Michigan.

TABLE II
COMPARISON OF SOME BIOCHEMICAL AND GROWTH CHARACTERISTICS OF ISOLATED STRAINS OF *A. lignieresii*, *A. suis* AND *A. equuli*

Organism	Lactose ^a	Glucose ^a	Sucrose ^a	Maltose ^a	Dulcitol ^a	Mannitol ^a	Nitrate Reduction	Urease Production	Action on blood	Growth on MacConkey's	Growth Charact.	Morphology
<i>A. lignieresii</i>	(+) ^b	+	+	+	-	+	+	+	Variable, usually negative	Variable	Serophilic granular growth in glucose serum broth	Gram negative non-sporulating short rod. Marked variability in length noted
<i>A. suis</i>	Variable	+	+	+	-	-	+	+	Strong B hemolysis	Usually negative	Same	Same
<i>A. equuli</i>	+	+	+	+	-	+	+	+	Non-hemolytic	Delayed - small rough colonies	Viscid growth in broth with a delayed granular deposit	Same

^aAcid production when dissolved in serum broth.

^bDelayed reaction in test, usually positive.

and may change after subculturing or storage (7). Table II summarizes some of the similarities and differences detected in the Edmonton laboratory between *A. lignieresi*, *A. suis* and *A. equuli*. The two most notable differential characteristics of *A. suis* are its negative reaction in Mannitol and its strong Beta hemolysis in sheep blood agar.

The economic significance of this infection remains unknown at the present time because of the limited number of isolations. The pigs were from premises widely scattered throughout central, northern and northeastern areas of Alberta. Isolations of the organisms have been made from animals varying in age from seven to ten days (Case #2) to four years (Case #1). However, all but two of the isolations were made from animals two months of age or younger. Based on the data presented, it appears that this disease may occur as a septicemia or as an arthritis which may be contracted from a navel infection. The significance of the isolates in Cases 1 and 7 was not determined.

SUMMARY

Clinical signs and results of pathology, histopathology and bacteriology have been reported for seven swine submissions from which *Actinobacillus suis* was isolated in Alberta in the years 1973-75. Some of the characteristics of the organism and its main differences from *A. lignieresi* are discussed. The prevalence and possible economic significance of this infection in Alberta swine remains to be determined.

RÉSUMÉ

Les auteurs décrivent les signes cliniques, les lésions macroscopiques et histologiques,

ainsi que les résultats d'examens bactériologiques, relatifs à sept envois de porcs desquels on isola *Actinobacillus suis*, au laboratoire provincial d'Alberta, entre 1973 et 1975. Ils commentent aussi certains des caractères du microbe et ses principales différences d'avec *A. lignieresi*. On ne connaît pas encore de façon précise l'étendue de cette infection, chez les porcs de l'Alberta, ni son importance économique.

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BOOK REVIEW

Current Techniques in Small Animal Surgery. Edited by M. J. Bojrab. Published by Macmillan of Canada, Toronto, Ontario. 1975. 585 pages. Price \$44.95.

This book recognizes the need for frequent updating of surgical techniques in small animal practice. It is primarily for the practicing veterinary surgeon and uses as little space as possible in reviewing basic surgical principles. Some diagnostic procedures such as biopsy prior to surgery are well written.

Dr. Bojrab has called upon ninety-three authors to describe the important features of his or her particular procedure whether tradi-

tional or new and has apparently asked for very clear, accompanying illustrations. The authors are chosen from a wide range of professors, instructors, staff surgeons as well as practicing veterinary surgeons.

Part I deals with soft tissues and Part II with bones and joints. The parts are subdivided, each subdivision covering a body system. There are some areas that are not covered but on the other hand a complete discussion of important new concepts such as closure of intestinal incisions is thoroughly discussed.

With the volume and variety of surgery in small animal practice today this book would be an important addition to every small animal library. *J. A. Hutchison.*