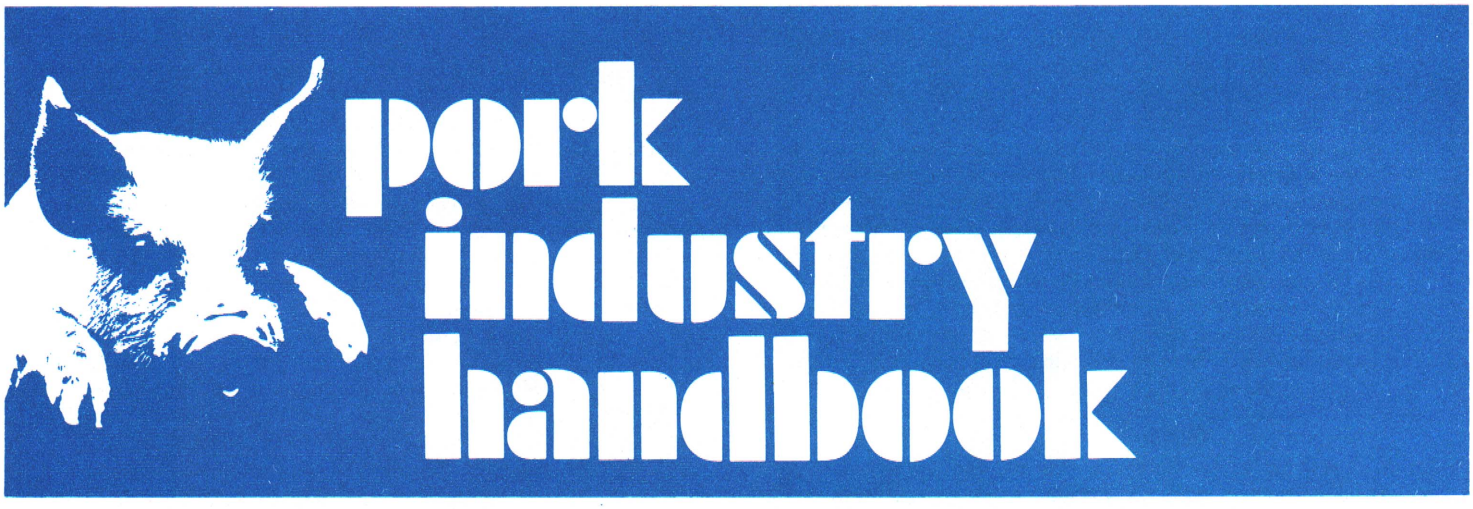

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Swine Arthritis

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Arthritis is commonly recognized as a major factor in swine lameness. The disease is caused by infection of the joint and the surrounding tissues by bacteria or mycoplasmas. United States Department of Agriculture (USDA) meat inspection records indicate that trimming the swine carcasses and discarding whole carcasses due to arthritis are leading causes of loss at slaughter. Of greater concern is the economic loss that occurs on the farm because of slower and less efficient gains and reduced performance by adult breeding stock and lactating sows. Death loss occurs in some instances but is not a major factor.

Other factors in lameness in swine include those related to nutritional imbalances or deficiencies, foot and leg lesions resulting from trauma and improper conformation and degenerative bone and joint changes.

Streptococcal Arthritis

Streptococci cause acute and chronic arthritis in swine of all ages. Most commonly this infection occurs in baby pigs where the disease may be identified as part of the "joint-ill" syndrome associated with navel infection.

The *streptococci* are classified serologically according to the Lancefield system. Representatives from virtually every one of the Lancefield groups have been isolated from swine; however, most isolates from naturally occurring arthritis belong to Group C (*Streptococcus equisimilis*), Group L, or Group D (*Streptococcus suis*).

Besides neonatal diarrhea and pneumonia, streptococcal infection is probably one of the most common diseases affecting young pigs. Streptococcal infection occurs under many types of management and environmental conditions. The organisms are common in vaginal secretions, respiratory tract secretions and sow milk. *Streptococcus suis* may be carried in the tonsils of clinically healthy animals. These organisms invade the pig's body by way of the navel, foot or skin wounds or the tonsils. Rough flooring or bedding material causes abrasions of the legs of nursing pigs that undoubtedly facilitate invasion by these organisms.

Streptococcal arthritis never affects a large percentage of pigs; the disease condition (morbidity rate) is usually less than 5%. Ten to 20% of affected pigs may die, either as a result of systemic lesions produced during the septicemic (pathogenic bacteria in the blood) stage of the disease or by causes related to impaired mobility (starvation, overlaying, etc.).

Clinical Signs. Acute streptococcal infection is characterized by a fever, roughened hair coat, depression and lameness. As the disease progresses, the affected pig may lose weight and have marked enlargement of the affected joints. One or several joints may be involved; swelling is most often observed in the knee, elbow and hock joints. The pain associated with the condition and the resulting impairment of movement restrict the ability of affected pigs to nurse.

Affected pigs are often stunted and have chronic arthritis for life. Affected joints contain increased amounts of cloudy joint fluid with clots of fibrin. There is swelling, discoloration and redness of the membranes. The connective tissue capsule around the joint is thickened and may contain small abscesses. As the disease becomes chronic there may be damage to the articular cartilage. Lesions also are observed in the growth plates of the bones. Other signs indicative of systemic infection also may be seen, particularly in *S. suis* infections.

Diagnosis. A sudden lameness with joint enlargement and a fever in pigs 1 to 3 weeks of age is highly suggestive of streptococcal arthritis. Joint and bone lesions also are very suggestive. Systemic lesions, such as enlargement and congestion of the lymph nodes, polyserositis (inflammation of the serous membrane), pneumonia, or meningitis are seen along with the arthritis in *S. suis* infections. The organisms can be isolated from the acutely arthritic joints by bacteriologic culture technics.

Prevention and Treatment. The recommended treatment in cases of baby pig arthritis is generally penicillin. Treatment is most effective if initiated before the disease is advanced. If inflammation has become chronic, the response to treatment

will be very poor. For *S. suis* infections, penicillin, ampicillin or lincomycin have been recommended. Antibiotic susceptibility (sensitivity) should be determined from bacterial cultures.

Use of autogenous or commercially available vaccines containing appropriate streptococcal antigens of Lancefield Group C have been reported to control streptococcal arthritis. A vaccine containing *S. suis* Types I and II also has been reported to prevent that disease. Streptococcal products have been used to vaccinate pregnant sows and thus confer immunity to the baby pigs through the colostrum. Strong emphasis should be placed on selection of the most appropriate isolate for preparation of autogenous vaccines. The diversity of *streptococci* involved may preclude development of appropriate products for all types of the organism.

Erysipelas Arthritis

Erysipelas can be an acute, subacute and chronic bacterial disease affecting pigs of all ages. In the acute form, the disease is generalized, involving all body systems. The chronic form is manifest primarily as arthritis, endocarditis, and/or inflammation of the heart valves. Erysipelas causes serious economic loss in most areas of the world where swine are raised.

Erysipelothrix rhusiopathiae, the causative agent of erysipelas, varies in virulence. It may be present in some herds and not have an adverse effect. In other herds the signs may be mild. Yet in some herds it may cause severe, explosive outbreaks with considerable death loss. Other factors that influence the severity of erysipelas include age of the pigs and level of immunity. Antibodies may originate from the colostrum, prior exposure to low virulent strains, or vaccine. There may be differences in resistance related to genetic influences, nutritional status or environmental temperature.

E. rhusiopathiae is carried in the tonsils and intestines of convalescent swine. Although it can be isolated from soil contaminated with swine feces, there is no evidence to support the belief that it can survive for long periods or grow in soil. The organism also causes arthritis in lambs, acute septicemic disease in turkeys and localized infection in humans who handle meat and fish.

Clinical Signs. Acute swine erysipelas often appears in a herd with the sudden death of one or more pigs. Affected animals may be depressed, have temperatures of 104° to 108° F., have poor appetites and be stiff, lame and reluctant to move. There may be shifting of weight from one leg to another in an attempt to relieve the pain. The feet may be placed well under the pig, giving the back an arched appearance. Such arthritic pigs will lie down frequently and may be reluctant or unable to rise. Welt-like lesions may develop in the skin during the acute stage. These lesions are firm, raised and, in light skinned pigs, they may appear light pink to dark purple. They are usually square or rhomboid in shape and often are called "diamond skin disease." Such lesions may heal or result in sloughing of necrotic patches of skin later on.

Subacute erysipelas is similar to acute erysipelas except that it is milder. Temperatures are not so high, the appetite may be normal, and there may be only minimal skin involvement or lameness.

Chronic swine erysipelas consists of chronic inflammation in the heart valves and the joints. Chronic arthritis may affect one or several joints and vary considerably in the amount of interference with locomotion. Affected joints may be markedly enlarged, stiff and, in some cases, so severely damaged that joint function is no longer possible.

Lesions in acute erysipelas are similar to those seen in other septicemic diseases of swine, with hemorrhages in various organs and serous membranes and acute inflammation of lymph nodes. The spleen may be enlarged. Affected joints have increased amounts of discolored joint fluid and swollen, reddened joint membranes.

In chronic arthritis the joints have thickened, discolored synovial membranes with increased amounts of connective tissue and infiltration of inflammatory white blood cells. The change may also extend into the ligaments and tendon sheaths near the joints. The joint fluid is red to brown and increased in amount. The cartilage covering the ends of bones in the joint may be severely eroded and necrotic. There may be growth of bone around the margins of the joint so that the joint cannot bend. Lymph nodes draining arthritic joints may be markedly inflamed and enlarged several times the normal size.

Diagnosis. Erysipelas arthritis is best diagnosed by isolation of the organism from affected joints; however, this is often difficult to do because the organism disappears or is present only in very small numbers in the chronic stages of the disease. Severe chronic inflammation of the joint membranes and surrounding tissues and damage to the bone and articular cartilage are highly suggestive of chronic erysipelas arthritis. A history indicative of acute erysipelas in the herd is suggestive of *E. rhusiopathiae* in cases of chronic arthritis. Serologic tests have been used for many years to aid in diagnosis, but because of difficulties in interpretation they generally are not used in the U.S.

Prevention and Treatment. Vaccination is well-accepted as a preventive for acute swine erysipelas. Killed products, known as bacterins, and certain live-attenuated vaccines are available. Selection of the appropriate product depends on the individual circumstances and experience on a given farm or in a given region. When bacterins are used, it is advisable to give 2 injections at 2 to 3 week intervals. Effective living avirulent vaccines for oral administration also are available. Vaccination apparently does not protect against the chronic arthritis as well as it protects against the acute disease.

In general, it is advisable to vaccinate pigs against *E. rhusiopathiae* at 8 to 10 weeks of age. Vaccination of gilts and sows 6 weeks prior to farrowing and again 2 weeks later has been thought to induce antibodies that are transferable to newborn pigs via colostrum.

Penicillin, in combination with antiserum against *E. rhusiopathiae*, is considered a good treatment for acute erysipelas. When this treatment is used properly in the acute stage, it is likely that little chronic arthritis will develop. Animals in which arthritis has already developed probably do not respond as well and those with chronic arthritis do not respond to this treatment. Corticosteroids may be used for temporary alleviation of the arthritic signs but probably do not influence the eventual outcome of the process.

Mycoplasmal Arthritis

Two species of mycoplasmas have been shown to cause arthritis in pigs. *Mycoplasma hyosynoviae* causes acute arthritis in pigs 10 weeks and older and *Mycoplasma hyorhinis* causes acute and chronic polyserositis and arthritis in pigs 3 to 10 weeks of age and occasionally in young adult swine. Both species can be isolated from the nasal cavities, the throat and lungs of carrier swine; however, they are not known to be primary causes of disease in the respiratory tract. They can be distinguished from *Mycoplasma hyopneumoniae*, the cause of chronic pneumonia in swine.

Mycoplasma Hyosynoviae

Arthritis caused by *M. hyosynoviae* occurs primarily in pigs 12 to 24 weeks of age and occasionally in young adult swine. *M. hyosynoviae* arthritis occurs in all breeds of swine, but it seems to be more frequent and more severe in genetic lines that are heavily muscled and that have poor leg conformation and poor leg action. A degenerative joint disease (osteochondrosis) may be an important predisposing factor in this disease. Stress associated with movement or mixing, transport or changes in weather are thought to predispose to the disease. It is quite common to see *M. hyosynoviae* arthritis in young boars 7 to 10 days after they have been introduced into a new herd.

In most outbreaks of *M. hyosynoviae* arthritis, less than 10% of the pigs are affected; however, in some severe cases more than 50% may be involved. Very few affected pigs die.

M. hyosynoviae becomes established in many pigs without producing evidence of arthritis. A high percentage of adult swine in infected herds carry the organism in their tonsils for long periods. Such carrier sows are undoubtedly the initial source of the organism, resulting in infection of some young pigs. The organism appears to spread from pig to pig after weaning (5 to 7 weeks of age). Later at 2 to 3 months of age, most pigs have the organism in their throats.

Clinical Signs. Onset of *M. hyosynoviae* disease is characterized by sudden appearance of lameness in one or more legs. The lameness varies in severity and duration, usually lasting 3 to 10 days. The pain may be so intense that the animal will not use the affected leg. Arthritis in rear limbs is characterized by limping, frequent flexion of the affected limb, shifting of weight and altered stance. The feet may be carried well under the body with the back arched. Front limb involvement is characterized by limping, stiffness or kneeling on the fetlock. Affected animals usually have difficulty in rising or may be unable to rise. Joint enlargement is usually not observed unless the hock is involved. Acutely arthritic swine may show slight to moderate weight loss, slight to moderate loss of appetite and slight rectal temperature elevations.

Joints with acute *M. hyosynoviae* arthritis are distended with turbid, yellow to red-brown fluid. Membranes lining the joints are thickened and yellow to red. The membranes often appear granular or velvet-like. Periarticular tissues may be swollen and the tendon sheaths may be inflamed. The joint cartilage generally appears normal.

Diagnosis. The age of the swine involved, the sudden onset of lameness and the nature of the lesion are symptoms which make tentative diagnosis possible. Joint fluid should be submitted for microbiological examination. *M. hyosynoviae* can be isolated from about 50% of the acutely affected joints. Samples collected from chronically affected pigs or those treated with antibiotics are usually negative for the organism.

Prevention and Treatment. Stressful conditions or practices that create unnecessary stress should be minimized during the susceptible age period in herds troubled with *M. hyosynoviae* disease. Breeding stock should be selected for their good leg conformation and leg action. Sows and boars should not be purchased from seedstock herds having a history of severe arthritis problems.

Injectable tylosin (Tylan®) has long been available as an effective treatment for *M. hyosynoviae* disease. Lincomycin (Lincocin®) is another drug shown to be effective for treatment of the disease. Treatment with either of these antibiotics is most effective if given during the early stages of the disease. Field reports as well as laboratory studies indicate the occurrence of cases of the disease which do not respond well to one or the other of these antibiotics. Well-documented evidence of the value of any medication given orally for prevention or treatment of *M. hyosynoviae* disease has not been presented. Corticosteroids are sometimes used to alleviate pain associated with the arthritis.

There is no vaccine for prevention of *M. hyosynoviae* arthritis, nor is there evidence that *M. hyopneumoniae* vaccines will induce protection against *M. hyosynoviae*.

Mycoplasma Hyorhinis

M. hyorhinis is a common inhabitant of the pigs' nasal cavity and a common secondary invader in swine pneumonia. It occasionally produces inflammation of the serous membranes of the pig's body and arthritis. The serous membranes cover the heart, lungs, abdominal viscera and testes.

M. hyorhinis disease occurs most frequently in groups of pigs with other diseases such as pneumonia or enteritis and where there is considerable stress caused by poor environmental conditions or poor management. The disease may occur in young adult breeding stock, especially first generation surgically-derived pigs when they are stressed or mixed with conventional or second generation SPF stock.

In most outbreaks of *M. hyorhinis* disease, the incidence of clinical illness is low, but in occasional cases up to 25% of the pigs may be affected. Mortality is generally low.

M. hyorhinis is carried in the upper respiratory tracts of a small percentage of adult swine. It is probably most often transmitted from these carriers to a few young pigs which then serve to spread the organism among penmates. Most challenged pigs never show any clinical signs of illness. *M. hyorhinis* is known to be a common secondary invader in pneumonia initiated by other organisms and may, under some circumstances, cause pneumonia in young pigs.

Clinical Signs. Pigs with early stages of *M. hyorhinis* disease have roughened hair coats and are somewhat depressed. As the disease progresses, clear evidence of abdominal and chest pain is seen. The pigs show stretching movements with the front and hind limbs extended, particularly when first aroused. Affected pigs may be tucked up and exhibit labored breathing. Some animals lie on their chest rather than on their sides. Poor appetites and slight temperature elevations may be seen. Some of the affected pigs develop lameness and enlargement of the joints. Swelling of the scrotum may be seen, especially in young boars.

The inflammation in the body cavities may continue for several weeks or months and result in stunting of growth. The arthritis often continues for at least 6 months causing lameness and reduced mobility. Clinical characteristics of the lameness depend on the severity of the disease and the joints involved. The lesions produced by *M. hyorhinis* in joints are similar to those produced by *M. hyosynoviae* except that they more often become chronic. There is increased, discolored joint fluid and the joint membranes are swollen and yellow to red. There may be fibrin clots in the joint fluid. Lesions in the chest, abdominal and heart sac cavities consist of accumulation of cloudy fluid with pieces of fibrin. As the disease progresses, adhesions develop. Such adhesions frequently are seen in pigs at slaughter.

Diagnosis. Appearance of arthritis accompanied by polyserositis (peritonitis, pleuritis and pericarditis) in 3 to 10 week-old pigs is very suggestive of *M. hyorhinis* disease. The organism can be isolated from the synovial fluid of arthritic joints and from the exudate in the body cavities. This disease must be differentiated from a very similar polyserositis and arthritis caused by *Hemophilus spp*.

Prevention and Treatment. Stress or other diseases that may predispose to *M. hyorhinis* disease such as pneumonia or diarrhea should be controlled.

There are no known effective treatments and no vaccine for this disease. *M. hyopneumoniae* vaccines are not known to induce cross-protection against *M. hyorhinis*.

Arthritis Associated with Other Septicemic Infections: *Haemophilus parasuis* and *Actinobacillus suis*

Systemic infections with bacteria such as *Haemophilus parasuis* and *Actinobacillus suis* often include mainfestations of arthritis. *H. parasuis*, known as Glassers disease, causes inflammation in the pleural, pericardial and peritoneal cavities, the joints and the meninges. Generalized signs of septicemia may be seen throughout the lymph nodes and abdominal organs. Arthritis is manifest as increased discolored fluid in the affected joints and inflammation of the membranes lining the joint spaces. Similar disease may be seen with other bacterial agents such as *Actinobacillus suis*.

Diagnosis of bacterial septicemic disease with arthritis is usually based on demonstration of post-mortem lesions and isolation of the causative organism. For therapy, treatment early in the course of the disease is mandatory. Specific antibiotics

which may be useful include penicillin or sulfonamides. Commercialy available vaccines have been released recently which have the potential to induce a good level of immunity. Herds with ongoing problems with *H. parasuis* may wish to consider vaccination.

Arthritis Associated with Tail Biting

Tail biting is a habit common in growing and finishing pigs. However, growth and feed conversion are impaired. Frequently the price of the animal is then docked at the time of sale to the packer.

Bite wounds in the tail or other sites such as the ear provide access for organisms to the blood stream. *Streptococcus spp., Staphylococcus spp.* and *Corynebacterium pyogenes* are most often involved in arthritis of this type. Arthritis due to tail biting usually is manifested by large swellings of the shoulder, elbow, hock or stifle joints. Involvement of the vertebral column may result from direct extension from the tail injury.

Many management factors are involved in control of tail biting. It has become common practice to remove the tail of very young pigs at the first joint from the body. Good technique must be used since contamination of the open wound following removal of the tail may result in development of the very disease that you are attempting to avoid.

Treatment of arthritis resulting from tail biting is very unsatisfactory.

Osteochondrosis and Osteoarthrosis

Osteochondrosis (OC, abnormal development of cartilage and bone) and osteoarthrosis (OA, degenerative joint disease) affect young pigs of both genders in all major hog producing countries. Clinical signs develop when pigs are between 4 and 6 months and tend to be most frequent and severe in fast-growing, well-muscled, lean pigs. Poor conformation may be an associated problem. Deformities caused by OC include bow-legs and cross-legs of forelimbs, and cow-hocks or sickle-hocks. The common sites affected by OA are elbows and stifles, but shoulders, hips, hocks and vertebral (spinal) joints also may be affected. Typically the conditions affect many sites at the same time.

Clinical signs include an unwillingness to move, a shortened stride, and, if elbows are affected, a desire to walk on the knees; affected pigs are usually very vocal if they are forced to move. Gilts and sows may be unwilling to stand for a boar and affected boars either cannot mount or fall off the sow before completing a service. Although OC and OA can cause "leg weakness," the degree of lameness may be governed by the pain threshold of the pig; those which do not feel pain or become lame may have extensive lesions.

Although losses caused by OC and OA are often ignored, they are probably a major cause of culling of breeding stock. The estimated cost to the U.S. pig industry is in excess of $24 million annually.

The causes of OC and OA are poorly understood, but appear to be multiple. Heredity is thought to be an important predisposing factor as there are breed differences in susceptibility for OC and OA; within breeds there is variability in the frequency of lesions in different lines. Although there has been no association between OC or OA and nutrition, if pigs are fed less and grow slowly, lesions develop more slowly and are less severe. However, by the time slow-growing pigs reach 230 lb, lesions are similar to those in pigs fed to appetite. Pigs that have severe lesions at slaughter may have overall slower growth rates. Initially, these pigs may have the fastest growth, but as pain becomes more severe they become inactive and eat less, thus losing body condition.

Excessive compressive forces over growth cartilages can initiate or worsen lesions. It is, therefore, possible that the increased muscle weight or the greater forces across joints caused by larger muscles in contemporary pigs make lesions worse. Exercise may improve movement of a pig and reduce the frequency of deformed limbs, but may not impact the severity of lesions in joints. The results of putting pigs on softer dirt lots or in deep bedding have been variable both for the degree of lameness and the severity of lesions.

Because specific causes of OC and OA have not been identified, treatment, control and prevention are difficult. Leanness and muscle mass are related to a higher frequency of severe lesions. Lesions also occur in faster growing pigs. Soundness does not insure the absence of lesions, and lesions cannot always be detected grossly or radiologically. Drugs that alleviate pain may simply mask the problems as may increased exercise or softer flooring. Antimicrobial compounds are of no value, because no infections have caused OC or OA. At present, the best preventive measures that can be suggested include selection for soundness and conformation, adequate exercise on non-slippery floors, and the supply of a suitable ration for normal development of joints and bones. Further investigations are needed to study genetic influences as well as microscopic and biochemical evaluation of cartilage from normal and affected pigs. Only more complex selection criteria would screen out a large percentage of arthritic pigs.

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Summary of major forms of infectious swine arthritis.

Type of arthritis	Primary manifestations	Age of pig affected	Recommended treatment*
Streptoccus spp.	Lameness, joint swelling (acute and chronic)	1 to 6 weeks	Penicillin
Erysipelothrix rhusiopathiae	Lameness, joint swelling with generalized disease (acute and chronic)	1 to 8 months	Penicillin antiserum
Mycoplasma hyorhinis	Lameness, occasional joint swelling and inflammation of membranes lining the heart, lung and abdominal cavities (acute and chronic)	3 to 8 weeks occasionally up to 12 months	None highly effective
Mycoplasma hyosynoviae	Lameness, acute and occasionally chronic	3 to 12 months	Tylosin Lincomycin
Haemophilus parasuis	Lameness, some joint swelling with generalized polyserositis or septicemia	5 to 12 months	Sulfonamides
Osteochondrosis Osteoarthrosis	Lameness, chronic but occasionally acute	from 4 months on	None specifically effective

*Treatment generally effective only in acute stage.

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