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Swine abnormalities

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Abnormalities occur more frequently in swine than any other species of farm animal. As a livestock producer, you're probably interested in causes and changes necessary to prevent recurrence of the condition.

The immediate question is whether the abnormality is caused by genetic or environmental factors or a combination. In some instances, determining a cause is complicated by the fact that some defects can be due to **either** genetic or environmental factors. A genetic cause is suggested by any or all of the following:

□ The defect occurs with one breed only, where other breeds share the same set of environmental circumstances.

□ The defect is associated with family (sire, for example) within a breed, where other families share the same set of environmental circumstances.

□ A new defect occurs with the introduction of new breeding stock.

□ The breeding stock stays the same throughout the breeding season, and the defect occurs evenly throughout the farrowing season.

□ Repeat matings produce the same results, in terms of numbers affected vs. numbers normal.

□ The ratio of normal to affected in the progeny is in accordance with expectation based on presumed genotypes of mated pairs. For example, matings involving a boar and his daughters should produce 12.5 percent affected and 87.5 percent normal, if the defect is inherited in the manner of an autosomal recessive.

Suggestions for controlling harmful genes in the herd

If the abnormality is caused by a dominant gene, you need only cull all animals showing the abnormal condition.

However, most inherited defects show an autosomal recessive pattern. The major problem in controlling these defects is in recognizing apparently normal animals that carry in hidden form the harmful recessive gene. Test matings can identify such carriers. A useful test is to mate the potential herd sire to five daughters produced in a limited number of matings. With an average litter size of seven, the production of 35 normal piglets (and no abnormals) would indicate that the boar is free of harmful recessive genes at a probability level of 0.01. This test has the practical advantage that it tests a potential herd sire for **any** harmful recessive gene(s) that he might be carrying. Subsequent use of boars determined to be free of harmful recessive genes would not eliminate the harmful gene(s) from the herd, since it would still be carried by at least some of the females.

An extensive study showed that swine had a higher proportion of defects than cats, cattle, dogs or horses. Defects occurring most frequently in swine, in order of incidence, were inguinal hernia, cryptorchidism, umbilical hernia, atresia of the anus and rectum and defects of the penis and prepuce.

Scrotal or inguinal hernia

This condition is widespread in the United States. It is present in males and is believed to result from a weakness of the musculature surrounding the inguinal canal, permitting the intestines to drop into the scrotum. It occurs with much greater frequency on the left side. Exercising extreme care in castration generally prevents great economic loss. Two pairs of recessive genes have been suggested as the mode of inheritance, but environmental influences are also likely to be involved.

This condition is not congenital but occurs from one day to one month after birth. There is a marked breed difference in the incidence of this defect as well as among family lines.

Dilation of the inguinal canal and excessive membrane strain during the first few days of life contribute to the problem.

Cryptorchidism

This is a common disorder in male pigs. Males with one testicle retained in the body are known as unilat-

eral cryptorchids (ridglings); those with both testicles retained are called bilateral cryptorchids.

Meat from these animals may have an undesirable smell and flavor, and this results in considerable economic loss to the pork industry.

Cryptorchidism is sex-limited and recessive. It is thought to be influenced by more than one pair of genes.

You could greatly reduce the incidence of cryptorchidism by culling all boars and gilts that produce cryptorchid pigs as well as sisters of carrier boars.

Umbilical hernia

A weakened supportive musculature in the navel area that results in intestines protruding through the belly wall is referred to as umbilical hernia, "belly rupture" or "belly bust". Some afflicted individuals die during growth because of strangulation of the intestine, but most reach market weight with no adverse effects. Surgical correction is seldom recommended. This defect is due to the umbilical ring opening too wide and remaining open at birth.

It is generally more prevalent in females. There is likely a genetic influence, but environmental factors also play a role.

Atresia of anus and rectum

With this condition, a pig is born without a rectal opening. Boar pigs generally die within a few days unless an opening is made to permit him to void his wastes. Females with no rectal opening can commonly defecate through the vagina, and they grow normally.

In a 1968 study, three types of matings involving normal and affected males and females were made, and the numbers of normal vs. atresia ani piglets were determined. (The defect was surgically corrected in males and in females used for breeding.) Ratios of normal to affected were reported to be 227:1 among progeny of normal x normal matings; 6:1 among progeny of normal males and affected females; and of 3:1 among progeny produced by mating affected males with affected females. These results indicate that atresia ani is influenced by genetic factors, but the pattern of inheritance is unclear. Likely, there are two or more pairs of genes involved.

Porcine Stress Syndrome (PSS)

This condition is characterized by sudden death after stress of heavy muscled pigs and/or the production of pale, soft, exudative musculature of their carcasses. PSS is believed to be a single-gene trait inherited in an autosomal recessive manner. Birth of a PSS pig incriminates both parents as at least carriers and possibly one or both to be positive. Halothane screening, creatine phosphokinase (CPK) testing and blood typing help to detect PSS positive animals. A 1983 article in the *Journal of Heredity,* indicated that some blood types are consistently associated with stress susceptibility, and others are consistently associated with stress resistance. Only one blood type had both resistant and susceptible individuals. Carriers appear to be superior to the noncarriers for several production and carcass traits. Use noncarrier boars to reduce the problem.

Congenital tremors (Myoclonia Congenita) Shakers or "Dancing Pigs"

This defect is present in piglets at birth and is characterized by rhythmic tremors of the head and limbs. Severity can range from slight shivering, with no apparent effect on performance, to shaking so severe that starvation results because the affected pigs cannot grasp the nipple to nurse. The severity generally decreases with age, and in some cases, disappears altogether.

The mode of inheritance is thought to be a simple recessive sex-linked gene which is usually transmitted through the dam only. Female piglets from carrier dams mated to normal boars are normal, while 50 percent of male piglets are affected. Other causes include prebirth infection by viruses such as pseudorabies and hog cholera.

Haemophilia (Bleeders) Von Willebrand's Disease

This condition is generally not expressed until three months of age or later and is not apparent until an accident occurs that provokes bleeding. Slow clotting time results in death from minor wounds. Inheritance is thought to be autosomal and recessive. It is not a simple autosomal recessive, but apparently it is influenced by modifying factors. The mode of inheritance is difficult to determine because there are a number of variant types of this disease. It is semilethal since some pigs live to maturity.

Splayleg

This condition, also known as spraddle legs, is probably the most common of the leg disorders. The rear legs are affected most often, but forelimbs are sometimes involved. Histological examination reveals myofibrillar hypoplasia of the semitendinosis and triceps muscles. In a recent study, significant differences in the incidence of splayleg were found among sires and among breeds; this indicates a genetic influence. Incidence of splayleg was significantly greater among progeny produced by Landrace boars. Comparisons of male and female progeny showed males to have an incidence 1.74 times that observed among female

progeny. Birth weights of affected piglets were also significantly lighter than those of normal piglets. It is apparent that splayleg is genetic, but environmental factors such as smoothness of the floors and other factors also play a role in the ultimate development of this defect.

Small inside toes

This condition may be genetic in origin. Duration of service is normally reduced in animals possessing this defect. Increased confinement production has put attention on this characteristic of hogs.

Bent legs

This abnormality generally affects only the forelimbs, although in isolated cases the rear legs are involved. The condition is lethal. The legs are bent at right angles and stiff. Some reports suggest this disorder to be recessively inherited, but more recent findings also implicate viral infection, plant and chemical poisoning, hyperthermia and dietary deficiencies.

Syndactyly

This disorder, also known as mulefoot or bush foot and recognized by the presence of only one toe per foot rather than two, is inherited as a single dominant gene. It has been nearly eliminated from the pig population in the United States.

Thick legs (Hyperostosis)

In this condition, necropsy will usually show extensive fibrous connective tissue, muscular hypoplasia and enlarged and edemic lymph nodes. It is usually lethal within a few days of birth. A simple autosomal recessive mode of inheritance has been postulated, but supporting data are limited.

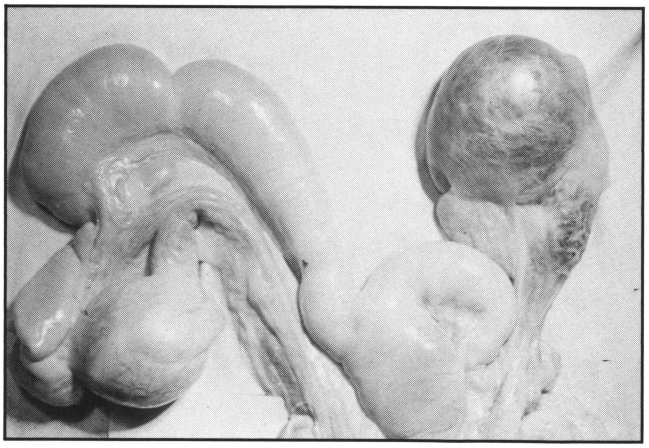
Cleft palate (Palatoschisis)

In this condition, the palate of the mouth fails to close during embryonic development. This is usually a lethal condition since the pig is unable to nurse. It is thought to be inherited as an autosomal recessive. Some evidence, however, suggests that this condition may be associated with environmental factors as well.

Intersexuality

This is common among the Large White and Landrace breeds of Europe and occurs with a frequency of .1 to .5 percent in Yorkshires and Landrace in the United States. Sex chromatin studies show most intersexes to be genetic females (XX genotype), but they possess portions of the male sex organs. There is probably more than one cause of intersexuality.

Intersexuality is common among some pig breeds.



The reproductive tract of an intersex pig includes portions of both male and female sex organs.

USDA studies suggest female offspring of known carriers to segregate in a 3:1 unaffected to affected ratio, and they assume a sex-limited recessive inheritance as the probable cause. Freemartinism also has been identified as one of the causes of intersexuality. It is usually caused by embryonic attachments that are closer than normal and development of a common blood supply.

Underline abnormalities

□ Inverted nipples are the underline abnormality of the greater concern. This condition is characterized by failure of nipples to protrude from the udder surface. The teat canal is held inward, forming a small crater so that normal milk flow is prevented. This abnormality has a genetic cause. The mode of inheritance is certain to be recessive, but the number of pairs of genes involved is unknown. Caution must be exercised in evaluating underlines since nipples surrounded by a ring of loose skin are not inverted if the nipple tip is present. Nipples located near the sheath of boars are often falsely accused of being inverted. In cases where the sheath nipples of males appear questionable, a check of underlines of littermate gilts often provides clues as to whether their brothers' underlines are in fact inverted.

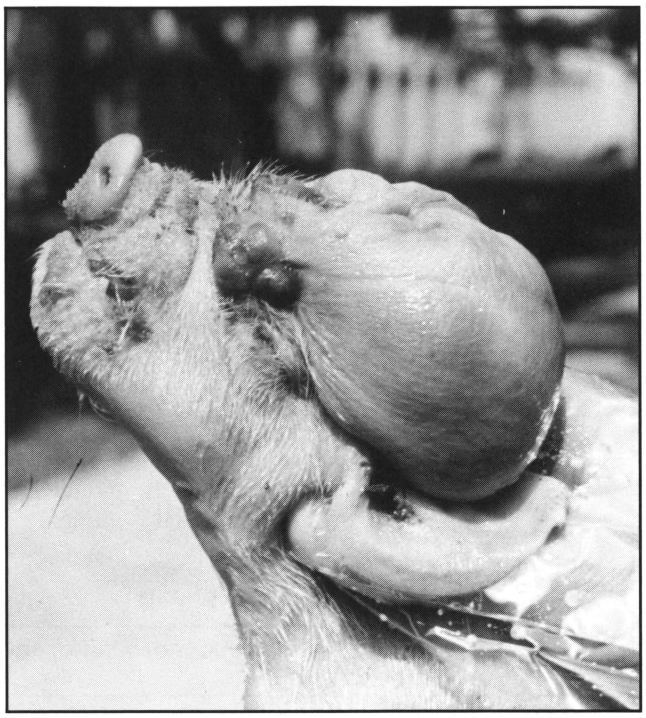
□ Blind nipples are those that simply have no visible nipple or canal. These in most cases are considered to result from injury, particularly from irritation and scabbing caused by abrasive floors. Covering the nipples with a commercially available paste material soon after birth has remedied this problem in most herds encountering the problem. Hence, blind nipples are not considered to have a genetic cause.

□ Pin nipples are small, undersized nipples that are commonly located between normally spaced large nipples. Purebred breeders have often discriminated against this condition. Their presence probably causes no economic loss if a sufficient number of normal sized nipples are present. The condition appears to have a hereditary component, although the problem has not received much attention by researchers.

Brain hernia (encephalocele).

Congenital brain hernia is a generally lethal defect in which brain tissue is extruded through a cleft in the skull. Both male and female piglets are affected.

This defect has been reported in a number of swine breeds including Poland China, Spotted Poland China, Landrace, Yorkshire, Duroc, and crossbreeds of Canadian York and Large English White. Reports of overall frequency of occurrences of this problem are few. A 1972 survey of cranium bifidum (skull clefting) in Missouri herds determined overall incidence on 12 farms to be 1.9 percent, but the rate on three of these farms exceeded 7 percent. A recent study by Vogt et. al. (1985) showed the overall incidence of brain hernia in the University of Missouri experimental swine herd to be 0.12 percent. Frequency of occurrences, by breed of sire, was 0 for Landrace, 0.13 percent for Yorkshire, and 0.17 percent for Duroc groups. Results of extensive pedigree analyses clearly showed brain hernia to be under genetic influence but the mode of inheritance is unclear.



A brain hernia is usually fatal.

Other disorders

Table 1 summarizes several other anatomical defects of swine. Those listed are of lower frequency, of lesser economic importance or less clearly understood than those conditions described in the text.

Summary

Developmental defects occur more frequently in swine than any other species of farm animal. Most are of a congenital nature and have been estimated to affect at least 1 percent of all newborn pigs. It is not known how much of the embryonic death that occurs in early gestation is due to developmental abnormalities. Researchers have suggested that perhaps as much as one-third or more of these deaths are due to developmental defects (chromosomal and genetic).

Nearly 150 congenital defects have been reported in swine. In only 13 percent of the cases was the cause known or believed to be genetic. Environmental factors were identified as the cause of a similar percentage. Hence, the cause(s) of these disorders are unclear in about 75 percent of the cases.

Since only on rare occasions has the frequency of any particular disorder presented an economic crisis to an operation, it is probably not advisable to devote a major effort in ridding a herd or breed of all developmental effects considered to have a genetic basis. Although you should place some emphasis on controlling the frequency of those disorders with the greatest economic importance, you'll receive greater

benefit if you place major emphasis on the production traits of maternal performance, rate and efficiency of growth, and carcass merit.

Table 1. Other anatomical defects of swine.

Disorder	Description	Probable cause(s)
Blood warts (melanotic tumors)	Mules or skin tumors. Increase in size with age. Tumors heavily pigmented and contain hair. Injury causes depigmentation. Common in Durocs and Hampshire.	Inheritance unknown but multigenic recessive inheritance has been postulated.
Gastric ulcer	Erosion of the epithelial lining of the stomach. Generally in the esophogeal region.	Heritability estimates ranging from low to moderate have been reported. Pelleted and finely ground rations, high unsaturated fats and low selenium in the diet, copper toxicity and psychosomatic factors have all been found as causes.
Humpback	Crooked spine behind shoulder.	Likely to have genetic cause, but inheritance is unknown.
Hydrocephalus	Fluid on the brain. Brain cavity much enlarged.	A recessively inherited lethal gene.
Lymphosarcoma (leukemia)	Malignant tumors of the lymph nodes with increased lymphocyte count.	Recessive inheritance probable cause in one herd studied. Viral etiology has been considered but not proven.
Rectal prolapse	Evagination of the terminal part of the rectum and anus.	No known genetic involvement. Numerous environmental influences including coughing, piling, feed constituents, antibiotics, diarrhea have been implicated.
Screen tail	Flexed, crooked or screw tail caused by fusion of caudle vertebrae.	Recessive inheritance has been postulated.
Swirls (hair whorls)	Hair forms a cowlick or swirl on neck or back.	At least two pairs of recessive genes are involved.

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