High Incidence of Polyarteritis Nodosa in the Brains of Culled Sows

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(Received 6 April 2004/Accepted 10 September 2004)

ABSTRACT. A total of 307 brains of purebred sows obtained from an abattoir were retrospectively examined. These sows were culled with reasons of reproductive failure, urogenital infections, or locomotor problems. The most common macroscopic lesions were cavitations or lacunae in the basal nuclei (9.1%, 28/307) and coarse and thickened leptomeninges with marked vessels (3.9%, 12/307). The most frequent microscopic lesion was polyarteritis nodosa (21.2%, 65/307), which was found in all 40 brains with the above-mentioned gross lesions and in all 25 brains with microscopic cerebral infarcts or cavitations. The affected arteries of polyarteritis nodosa were distributed primarily in the cerebral leptomeninges, basal nuclei, and internal and external capsules. Histopathologically, a characteristic change of the affected arteries was transmural fibrinoid necrosis with severe infiltration of mixed inflammatory cells; narrowing or occlusion of the lumen. The inflammatory cells were chiefly composed of lymphocytes, macrophages, and plasma cells, with a few eosinophils and occasional multinucleated giant cells. Polyarteritis nodosa was found at a high percentage in the brains from culled sows. It may result in cerebral ischemia, infarcts, and hemorrhage, and possibly play a role in the necessity for culling due to locomotor problems.

KEY WORDS: brain, culled sow, polyarteritis nodosa.

Assessing the reasons for the culling of sows in swine breeding herds is the first step to understanding and controlling the factors influencing sow losses. Common reasons for culling of sows include reproductive failure, urinary infections, locomotor problems, replacement as well as age [3, 13]. Data on the role of brain lesions in the need for culling is limited. The objectives of this retrospective study were to examine brain lesions in culled sows and to investigate their role in the culling of these animals.

Brains obtained from 307 culled sows of two purebred breeding herds were included in this retrospective study. The included sows all either weighed more than 150 kg or were more than 1 1/2 years old. The actual age and body weight were not determined individually. The majority of culling sows were reported a previous history of locomotor problems, urogenital infections, or reproductive failure. The clinical history of each individual animal was not provided. All animals had been routinely immunized against classical swine fever (hog cholera), pseudorabies, Japanese B encephalitis, and erysipelas. After electric stunning and bleeding, the brains were immediately removed and fixed in 10% neutral buffered formalin for at least one week.

Macroscopic examination was performed on each brain. Tissue sections were collected from various regions for histological examination including the olfactory bulb, cerebrum, basal nuclei, geniculi, corpora quadrigemina, hippocampus, medulla oblongata, choroid plexus, and cerebellum. The brain tissues were embedded in paraffin, cut at 6 µm, and routinely stained with hematoxylin and eosin. Special stains including periodic acid-Schiff, van Gieson’s, Masson’s trichrome, Congo red, Luxol fast blue-Cresyl fast violet, von Kossa’s, and Perls iron stain were used when required as ancillary methods to identify suspected lesions.

The main gross lesions identified were cavitations or lacunae in the cerebrum (9.1%, 28/307) and coarse and thickened leptomeninges with marked vessels (3.9%, 12/307). The cavitations usually were multiple, variable in dimensions and usually located in the basal nuclei and the internal or external capsule (Fig. 1). The cavities were irregular in shape and well-demarcated from the surrounding brain parenchyma. Irregular and thickened leptomeninges with congested blood vessels were the second most common gross finding. The lesions of the leptomeninges were thick and opaque, and some showed brown discoloration indicating previous hemorrhage. Nodular swellings were noted along the course of meningeal arteries.

On microscopic examination, the most significant finding was polyarteritis or periarteritis nodosa (21.1%, 65/307) (Fig. 2). Forty of 65 of these brains had macroscopic lesions, including 28 with cavitations in the basal nuclei and 12 with thickened leptomeninges. The remaining 25 brains with periarteritis nodosa had microscopic cavitations or cerebral infarct in the basal nuclei. The affected arteries were distributed primarily in the cerebral leptomeninges, basal nuclei, and internal and external capsules, less frequently in other sites in the cerebrum, and were not found in the cerebellum. Lesions of different stages were found. In the early stage, the arteries or arterioles underwent advanced, transmural fibrinoid necrosis with severe infiltration of mixed inflammatory cells; narrowing or occlusion of the lumen was a characteristic change. The inflammatory cells were chiefly composed of lymphocytes, macrophages, and plasma cells, with a few eosinophils and occasional multinucleated giant cells. The areas supplied by the affected vessels showed variable-sized ischemic infarcts or lacunae characterized by cavitations with the presence of hypertrophic astrocytes, gitter cells, hemosiderin-containing macrophages, and vascular siderosis as well as expanded

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perivascular spaces. The walls of arteries in an advanced chronic lesion were often replaced by collagen-rich, fibrous connective tissues with an onion-skin appearance. Evidence of recent hemorrhage was also seen in some cases.

Most of the published data on polyarteritis nodosa in the veterinary field were case reports or studies which focused on specific vascular changes [2, 7, 10, 12]. None of them have dealt with reasons of culling sows. The present study is one of the largest reported investigations of brain lesions in culled sows. Our finding of a high incidence of polyarteritis nodosa has not been reported in previous studies of brains from culled sows.

Polyarteritis nodosa or periarteritis nodosa is a necrotizing vasculitis affecting small- to medium-sized muscular arteries that has been thought to be an immune complex disease [4]. The disease has been reported in humans [6, 14], dogs [8, 9], pigs [2, 5, 7, 16], and other animals [4]. Multiple organs may be involved with the lesion sites varying from case to case, including the kidney, heart, gastrointestinal tract, skin, lung, and brain. There have been two reports of cerebral polyarteritis nodosa without other organ involvement in pigs [2, 10]. Streptococcal infection is one of the etiological factors associated with hypersensitivity vasculitis and has been considered as a possible cause of polyarteritis nodosa [2, 11, 14, 15]. Previous studies also reported that streptococcal meningitis was frequently encountered in Taiwanese pig farms [12]. In a study from a breeding farm by Corner and Jericho, 11 adult pigs with necrotizing arteritis in the brain were reported. Although they found a lack of direct evidence of preceding streptococcal infection, there was an anatomic and epidemiological relationship between streptococcal meningitis and polyarteritis nodosa, suggesting a possible causal role [2]. In the present study, there was a high correlation between the presence of cerebral infarcts or cavitations and polyarteritis nodosa. The affected sites were almost exclusively in the basal nuclei and internal and external capsules, and were therefore considered to be responsible for abnormalities in behavior, muscle tone, and control of motor activity [1]. Corner and Jericho [2] also observed that pigs with necrotizing arteritis in these anatomic areas often showed lack of coordination, clonic spasms, head tilt, posterior paralysis, and ataxia. In this study, macroscopic and histological examination of the brains of culled sows revealed a high incidence of polyarteritis nodosa resulting in cerebral ischemia, infarcts, and hemorrhage, which suggests a potential role of this disease in locomotor disorders responsible for culling of sows. In addition, the present findings is to raise awareness of polyarteritis nodosa causing economic loss of culling sows and the role of streptococcal infection involving pathogenesis of polyarteritis nodosa.

ACKNOWLEDGEMENT. The authors would like to thank Mrs. S.C. Wang of the Animal Technology Institute in Taiwan for her excellent work in preparing histological sec-
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