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Case Report

Congenital Abnormalities in German Holstein Twin Calves

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ABSTRACT

In this study, A two-days-old female German Holstein twin calf borned with cranial defect. The calf was died shortly after the clinical examination and performed necropsy. Pathological-anatomical examination showed multiple malformations including hydrocephalus internus and cerebellar hypoplasia, syringomyelia in the cervical and proximal part of the thoracic spinal cord, hydromyelia in the distal part of the thoracic spinal cord. Additionally, scoliosis was seen between the fifth and seventh thoracic vertebral locus and bilateral keratitis were observed. Its male co-twin calf with brachyury and also dam of the twins were positive for Bovine Viral Diarrhoea (BVD) antibodies by ELİSA Test. We descript congenital malformations in German Holstein Twin on the pathological-anatomical examination in detail associated with BVD Infection in this case report.

İkiz alman Holştayn buzağıda kongenital anormallikler

ÖZ

Bu çalışmamızda, iki günlük yaşta ve farklı cinsiyette ikiz Alman Holştayn buzağılarda bazı konjenital anomaliler tespit edildi. Dişi olan buzağı kraniyal defekt ile dünyaya geldi. Buzağı klinik muayeneden kısa bir süre sonra öldü ve nekropsi muayenesi yapıldı. Patolojik-anatomik muayenede hidrosefali internus ve serebellar hipoplazisi, torasik omuriliğin servikal ve proksimal kısmında siringomyeli, torasik omuriliğin distal kısmında hidromyelia gibi birçok malformasyon saptandı. Ek olarak beşinci ve yedinci torasik vertebra lokusu arasında skolyoz görüldü ve bilateral keratit gözlendi. Bracyury (Kısa Kuyruklu) erkek olan ikiz buzağı ve ikizlerin annesi olan inek, ELİSA Testiyle Bovine viral diyare (BVD) antikorları için pozitif sonuç bulundu. Bu olgu sunumunda, Alman Holstein İkiz Buzağılarda'ki patolojik-anatomik muayenede BVD Enfeksiyonu ile ilişkili olabilecek konjenital malformasyonları tanımladık.

INTRODUCTION

Congenital defects can be caused by genetic or environmental factors or a combination of both. In some cases, the cause of the defects is unknown. Hydrocephalus is a congenital malformation characterized by an accumulation of abnormal amounts of cerebro spinal fluid in the cranial cavity. If the fluid is accumulated in the lateral ventricular system it is termed as internal hydrocephalus and when the fluid accumulation takes place in the third and fourth ventricle and sub-arachnoid cavity it is named external hydrocephalus (1). This abnormal development of the brain may be caused by hereditary, infectious or nutritional factors (2). Hydrocephalus has been commonly seen in dogs, cattle and cats (3). In all major beef and dairy breeds including Hereford, Shorthorn, Ayrshire, Holstein-Friesian, Jersey and Angus (4,5) this condition was reported. Hydrocephalus was first described as an autosomal recessive trait in Hereford calves (6). Hereditary forms were described for Holstein, Guernsey, Shorthorn and Jersey cattle (7). The clinical signs, usually present at birth, are characterized by recumbency with extended limbs, intermittent opisthotonus and ataxia. Some affected animals are stillborn or die a few days after birth. When born alive, the calves may be recumbent, typically with their heads thrown back along the side of their body. They are weak and generally unable to rise, stand, or nurse unaided. Several syndromes associated with hydrocephalus have been described in cattle including hydrocephalus, microphthalmia, myopathy, alopecia and retinal dysplasia (8).

Defects of the cerebellum are common and vary from aplasia to hypoplasia. Hypoplasia may be characterized by reduction of one or more of the cerebellar cortical layers and by reduction of white matter. Clinical signs may include muscle trembling, ataxia and paresis (9). Prenatal infections with viruses such as bovine viral diarrhoea (BVD) and bluetongue virus are frequent causes for cerebellar hypoplasia (8). The BVD virus belongs to the pestiviruses of the family flaviviridae (10) and is capable of causing serious clinical disease in cattle, abortion, mummification, weak and undersized calves or malformations in newborn calves. Teratogenicity of the BVD virus in the foetus hinge on the level of pregnancy at the time of contagion. Different lesions was occured in aborted as well as in untimely or at full-term delivered animals. Lesions of the nervous system develop generally after inoculation in the second trimester of gestation. The most common congenital anomaly is cerebral hypoplasia, although rarely cranial defor-

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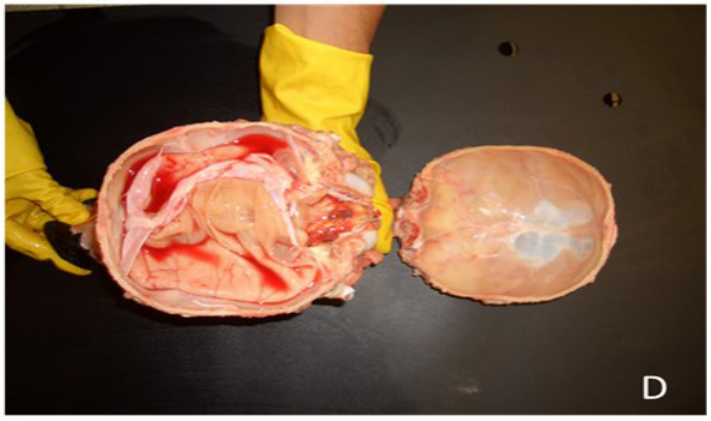
mation, hydrocephalus and hydranencephaly, dysmyelination of the spinal cord, microphthalmos, cataracts, chorioretinopathy and brachygnathia are observed (11,12). Acquired cerebellar hypoplasia prometes coming after cerebellar infection by blue tongue virus, BVD or akabane (13,14). Congenital cerebellar defects in calves may be single isolated entities or associated with other brain defects such as hydrocephalus. The clinical signs, usually present at birth, are characterized wide-based stance and ataxia (7). The pathological changes in genetic cerebellar aplasia or hypoplasia in calves seem to differ from BVD virus-induced defects. The purulent process and oculer lesions observed in BVD cases have not been defined in the genetic form (8). Taillessness syndrome in Holstein cattle was previously reported (15,16).

The aim of the present study was to analyse a case of congenital hydrocephalus in a two-days-old female German Holstein calf where its male co-twin was afflicted with brachyury, and both calves showed a positive serological result for antibodies against the BVD virus.



Case History

The twins were born from a 5-year-old German Holstein cow after normal gestation length. Three calves born previously were phenotypically normal. The female twin showed an enlargement of the skull (dome shaped skull) and the male co-twin had a shortened tail (brachyury) (Fig. 1). The study protocol was approved by the institutional animals ethics committee of University of Veterinary Medicine Hannover, Tierschutzgesetzes (with no: 3.5/16.02.2015). At the age of one day, the calf with the hydrocephalus was transferred to the Institute for Animal Breeding and Genetics, University of Veterinary Medicine Hannover and then submitted to pathological examination. The twins were clinically examined. Both twin calves had normal body size and weight for this breed. The female calf showed dom shaped skull have permanent recumbency and opistothonus (Fig. 1C). Pupillary and sucking reflexes were absent and not drunk colostrum anyway. Keratitis was obvious in both cornea and an iridocyclitis were seen in the left cornea (Fig. 2). Serum samples of both twins and its mother were tested for BVD virus antigen (Ag) using ELISA (cooker check BVD Ag /Serum Plus, IDEX Laboratories) and BVD virus antibody (Ab) (cooker check BVDV Ab, IDEX Laboratories). The positive antibody reactions against the BVD virus were observed in the serum of the dam and both twins. The virological tests for BVD-antigen were negative.

Pathological Findings

The female calf died shortly after the clinical examination and this calf was performed necropsy. The bone marrow of the female calf was red and hematopoietically active. The right occipital condyle was poor angled and deformation of the corresponding cranial joint surface of the atlas was present. The ground surface of the skull base was deeper (Fig. 1D). The sutures of the skull were membranous on a length of 7 cm and a width of 4 cm. We measured 400-500 ml clear and serosanguinous fluid in the skullcap (Fig. 3A). A scoliosis was seen between thoracic vertebrae 5-7. Multifocal atelectasis and bronchopneumonia was found in the lungs (Fig. 3B). The spleen was lighthyperaemic (Fig. 3C). In both kidneys a diffuse black-brown stain of the renal cortex was observed (Fig.

3D). The cornea of the left eye was edematous and both eyes showed filmy. High-grade hydrocephalus internus with atrophic cerebral cortex and low to moderate cerebellar hypoplasie were found (Fig. 3A). The severe central canalicular extension and diffuse moderate subdural oedema was detected in the spinal cord.

The thymus cortex showed mild depletion. The lung had mild multifocal catarrhal-purulent bronchopneumonia including individual syncytial cells and alveolar histiocytosis. In the kidney, a fine grained brownish intracytoplasmic pigment was detected in the tubular epithelial cells. Both of the left and right cornea had a severe diffuse oedema, moderate multifocal erosive keratitis and multifocal lymphohistiocytic iridocyclitis. The nervus opticus had mild diffuse gliosis. The cerebral cortex was narrowed. In the cerebellum, ectopic and segmental loss of Purkinje cells were detected. The syringomyelia was found in the central channel of the cervical spinal cord and up to the fifth thoracic vertebra dorsolaterally. In addition, hydromyelia of the spinal cord was found caudally to the seventh thoracic vertebra. The other male co-twin calf was observed only brachyury as congenital anomaly, except for its general health condition was good.

DISCUSSION

In this case, we described hydrocephalus internus and cerebellar hypoplasia with sceletal anomalies in the female Holstein twin. Hydrocephalus may be accompanied by skull and long bone defects (17). In addition, similar lesions of the cerebellum like aplasia or hypoplasia have been previously reported for cases with hydrocephalus internus (1,18,19). The histological changes of central nervous system that have been associated with BVD virus infection include irregular of Purkinje cells, disorganization of the internal granular layer (19). Similar histological changes of cerebellar hypoplasia and hydrocephalus such as ectopic Purkinje cells and segmental loss of Purkinje cells were detected. Syringomyelia suggests to liquid backlog and cyst formation in the parenchyma (20). Hydromyelia is a abnormal case described by backlog of liquid within an extended central canal of the spinal cord (21). Syringomyelia and hydromyelia may be inherited or acquired after alteration of cerebrospinal liquid pressure as can appear with hydrocephalus, foramen magnum anomalies, abnormal growth of the parenchyma and obstruction of cerebrospinal liquid flow because of neoplasia or purulence (15,20,22). In this case, the hydromyelia and syringomyelia may have been a result of scoliosis and hydrocephalus. Clinical signs of syringomyelia often contain paresis of all extremities (20) but not in the present case.

Congenital hydrocephalus in cattle was usually accompanied by multiple ocular anomalies such as retinal dysplasia, cataract and microphthalmia (23,24). In our case the bilateral cataract parallels previous observations. However, in a study by Bistner et al. (1970) iridocyclitis was not found in five calves affected with the BVD virus. In contrast to our case, an iridocylitis of the left cornea was seen.

Clinical signs such as permanent recumbency and opisthotonus were consistent with signs reported for cerebellar hypoplasia (7).

Anury may be a lethal attribute in animals such as cats, dogs and mice (16). Anury syndrome was reported for Holstein cattle (16). Buck et al. (2009) showed congenital anury in a calf due to BVD virus infection. The congenital brachyury of the male co-twin may be due to BVD virus infection. Other congenital deformities with exception of the brachyury were not detected in male co-twin.

Many researches attribute internal hydrocephalus to recessive hereditary factors (5,6,17,25), others to environmental factors (14,19,24,26). For this case, we demonstrated a positive antibody reaction against the BVD virus. Therefore, it was not thought to be a hereditary effect.

The infection of pregnant animals by BVD virus causes developmental anomalies, abortion or diseases including ocular and neurological defects (7). Timing of infection in a pregnant cow is crucial to the generation of persistently infected (PI) animals. If incur of the dam occurs second trimester of gestation the genesis of a PI calf might occur (7).

Effective and fruitful use of correct diagnostic tests is necessary for the estimation of BVD virus antigen (Ag) or specific antibodies (Ab). These tests will return changing results trusting on the antecedents or actual BVD virus infection situations (27). Animals that have never been subjected to the virus will test negative for Ab, Ag, and virus (27). Lanyon et al. (2014) reported cows or late-period, immunocompetent foetuses that have exposed to an acute infection will test Ab positive and, usually, Ag or virus negative, while PI individuals will return a positive Ag or virus test and negative Ab result.

Calves exhibiting hydrocephalus died at birth or died shortly thereafter (6). Survival time of the present case was only two days.

In conclusion, German Holstein twin calves infected with BVD virus showed very different congenital malformation and survival times. The female twin diying exhibited severe lesions of the central nervous system including cerebellar hypoplasia, internal hydrocephalus, scoliosis, syrongyomelia and hydromyelia, whereas the male co-twin only had a brachyury and alive.

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