

Short Communication

Splay Leg in a Dutch Laboratory Rabbit Colony: Detection Methods and Effective Elimination Procedure

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ABSTRACT

In rabbits, especially in some races, limb movement disorder called splay legs, are mostly unilateral or bilateral in front or hind legs at an early age. The severity ranges from mild to severe in this case. In breeding colony of albino Dutch laboratory rabbits, the splay leg disorder has been observed over the years permanently. Within the scope of this research, 1.5-2.5% of 700-750 number of colonies population, were affected. Splay legs were observed in 20-50 days old infants of both sexes. According to breeding system in metallic cages, it was thought that the mechanical trauma and damage to limbs has been the main cause of this problem. In this study, the accurate survey in histopathology and radiography of suffering organs was performed but any agent was seen. As some nutritional deficiencies lead to muscular atrophy and paralysis, feed analysis was also performed. In analysis of nutrients, all of the nutritional factors were in normal ranges. As is regarded, in laboratory rabbits especially in Dutch strain, effect of hereditary factors to creation of the splay legs, are listed in some valid reports. During the 8 gestation periods in 2 years, suffering infants with their apparently healthy family (other infants and their parents) that could act as gene carriers were identified and eliminated. After the next four gestation periods, the colony was controlled again. During this time, no case of affected animal was seen. With this action, the percentage of splay leg observation have reached to zero and it was completely eliminated.

Keywords: Splay leg, Laboratory rabbit, Detection, Elimination

INTRODUCTION

A number of disorders characterized clinically by complete abduction of one or more legs and the inability to assume a normal standing position are described by the term "splay leg" (Joosten *et al* 1981, Saunders & Davies 2005, Fox *et al* 2002). This condition is seen in young rabbits from neonates to juveniles that are several months old. Young kids 3 to 4

weeks of age are most commonly affected. The condition may be unilateral or bilateral and may affect the anterior, posterior or all four limbs in both sexes. The degree of splaying may be relatively mild, or so severe that the animal is completely unable to walk. The hind limb anatomy is more commonly affected in juvenile rabbits and the front limbs more commonly in our senior rabbits. The severity of the condition ranges from light to paralysis (Harkness & Wagner 1989, Richardson 2000, Suckow *et al* 2002, Suckow *et al*

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2010). In the Dutch breed, splay leg has been associated with either a single autosomal recessive gene with incomplete penetrance or as a polygenic condition with environmental modulation (Joosten *et al* 1981). Other causes are traumatic or iatrogenic. The latter applies to newborn rabbits that are overfed by the doe or that is living in a nest with a slippery surface due to lack of bedding, that results in the inability to pull the legs in under the body and the subsequent inability to walk effectively. (Arendar & Milch 1966, Jirmanova 1983, Gentz & Carpenter 1996, Suckow *et al* 2012). Rabbits suffering from genetic splay leg are usually alert and responsive. They are not paralyzed, eat normally and have general healthy appearance. Although the precise pathogenesis of splay leg is not entirely understood, at least some cases are ascribed to inherited disorders (Botdell 2000, Deeb & Carpenter 2003, Donnelly 2004, Flatt *et al* 1974, Harcourt-Brown 2002). When a rabbit is seen with splay legs, the first steps should be to check for physical deformities. X-rays will expose skeletal deformities like, pelvic hypoplasia with femoral luxation, torsion or subluxation of the hip, femoral neck anteversion, femoral shaft torsion, and distal foreleg curvature (Patton *et al* 2008, Silverman & Tell 2005). Other conditions that lead to weakness of the limbs should be considered including, malnutrition, vitamin E-selenium deficiency, severe sarcocystosis and toxoplasmosis (Blas & Wiseman 1999, Cheeke 1997, NRC 1995, Turan *et al* 1997, UFAW 2010). There is no reported satisfactory treatment for splay leg, so each case should be evaluated on an individual basis. Indeed, rabbits showing light deformities can move around quite well and thus have a good quality of life. For rabbits severely affected by splay leg, euthanasia is appropriate for most cases, particularly if more than one limb is affected. (Fox *et al* 2002, Richardson 2000, Saunders & Davies 2005). Because splay leg is considered to be inherited in a simple autosomal recessive pattern, breeding of the affected animal and its parents should be discouraged (Arendar & Milch 1966, Jirmanova 1983, Fox *et al* 2002).

MATERIALS AND METHODS

In 1.5-2.5% of infants in 700-750 albino Dutch laboratory rabbit breeding colony, in aged 20-50 days old, the splay leg in the forms of unilateral or bilateral paralysis of forelimb or hindlimb of both sexes was seen over the years. The hind limbs were more commonly observed. Rabbits suffering from this condition were usually alert and responsive. They were eating normally and had general healthy appearance, but couldn't adduct limbs and had difficulty in making normal locomotory movements (Figure 1).



Figure 1. Two infant rabbits aged 20 and 35 days old with typical sign of splay leg in the hindlimbs.

According to breeding system in metallic cages with mesh floor and net doors, it was thought that the mechanical trauma has been the cause of this problem by hawing of limbs among the holes of mesh floor or net doors which causes damaging organs. Since the occurrence of splay leg, in addition of mechanical damage, the other factors may also be involved, in this study, it was attempted in all suspected cases, careful consideration should be done. In clinical examination of affected rabbits, there have not been any swelling, or abscesses in body surface. Affected rabbits did not show any reaction to pain. At first, in order to accurately assess the health of the nervous, muscular and skeletal system of involved organs, the radiographic images (x-ray) were obtained from some rabbits affected organs. Also after euthanasia by CO₂

and necropsy, the affected areas were cut and prepared for pathological study. The specimens were kept in 10% formalin until the examination time. Since, the malnutrition and the lack of some nutrients such as vitamin E and selenium, as well as diseases such as toxoplasmosis and acute sarcocystosis, cause severe physical weakness, muscular atrophy and paralysis symptoms in rabbits, the nutritional diet rations were analyzed carefully for various nutrients. Also the mentioned diseases were scrutinized in health monitoring rabbits colony. As regards, in laboratory rabbits specially Dutch strain, effect of hereditary factors to creation the paralysis in limb, are listed in some valid reports, during the 8 gestation period in involved rabbits colony in 2 years, the identification of affected infants with their apparently healthy family (other infants in family and their parents) that introduced to gene carriers for elimination was done until the animals carrying the gene of splay leg in the colony to gradually decrease and eventually eliminate the disease. Also after the next four gestation periods, the colony was controlled again. In this period, the general state of health was observed and controlled daily. The breeding colony was controlled for new cases of disease.

RESULTS AND DISCUSSION

In clinical observation, there have not been any swelling, abscesses and reaction to pain in the affected organs. In clinical In radiographical survey, no abnormality in skeletal system was seen (Figure 2).



Figure 2. Radiographical image of affected infant rabbit. (any abnormality in skeletal system is observed)

In necropsy of animals, no certain pathological lesions was observed in various organs and tissues. On histopathological examination of prepared sections of the affected area, no specific pathologic lesion was observed in nerveous, muscular and skeletal tissues. In results of the full analysis of food pellet, the amount of vitamin E and selenium were in the normal range for the growth stage and there was no need to increase their rations. In laboratory rabbits especially Dutch strain, effect of hereditary factors to creation of paralysis in limb, are listed in some valid reports. In this study, during the eight gestation period for two years, the paralyzed infants with their apparently healthy family (other infants and their parents) were eliminated. This was done to eliminate the gene carriers. After this period, in next four gestation periods, the colony was controlled again. During this time, never case of affected animal was seen. With this action, the percentage of splay leg observation have changed from 1.5-2.5% to zero. Therefore, the cause of each mechanical agents to creation of disorder cancelled and hereditary factors were confirmed. With elimination of carrier animals, after some gestation periods, the creation of splay leg eradicated in breeding rabbits infants colony. (Arendar & Milch, 1966, Jirmanova, 1983, Fox *et al* 2002). Splay leg is a nonspecific term used to describe any condition affecting the limbs that prevents standing. This condition is generally a developmental musculoskeletal condition and is commonly seen in rabbits ranging in age from a few days to a few months. These rabbits are unable to adduct from one to all four limbs, so they cannot ambulate effectively. Hindlimbs are more commonly affected with femoral neck anteversion, femoral shaft torsion and sublaxations of the coxofemoral joint. Some reports suggest that the condition is associated with inherited achondroplasia of the hip and shoulder, while others indicate that a recessively inherited anteversion of the femoral head can be involved (Linsey & Fox 1974, 1994, Fox *et al* 2002). In the Dutch breed, splay leg has been

associated with either a single autosomal recessive gene with incomplete penetrance or as a polygenic condition with environmental modulation (Joosten *et al* 1981, Manning, *et al* 1994). It has been further speculated that some cases of splay leg are the result of teratologic malformations (Flatt *et al* 1974). Arendar and Milch (1966) reported that splay leg is a recessively inherited form of femoral neck anteversion, femoral shaft torsion and subluxation of the hip in the laboratory lop rabbit and its possible relationship to factors involved in so-called congenital dislocation of the hip. Joosten *et al.* (1981) published a report of a limb defect in rabbits known as splay leg arose in a closed breeding colony of Dutch rabbits. They suggested that since the causes of this postural deformity are not fully understood, an effort was made to clarify the mode of inheritance and the etiology of the disease. According to pedigree analysis and genetic mating tests they showed that, in contrast to published reports, the disease was not determined by a single recessive gene with complete expressivity. A hypothesis was presented in which imbalanced development of the neural, muscular and skeletal systems of the limb was the primary defect. It depends on the degree of femoral torsion and the capacity of the young rabbit for compensation by exorotation of the limb in the hip whether a persistent splay leg posture would developed (Joosten, *et al* 1981). As is regarded in accurate survey in histopathology and radiography of suffering organs and analysis of diet, no factor has role in creation of disorder. By elimination of affected animals and gene carriers, within the period mentioned, the splay leg has been eradicated in the breeding colony and its role in hereditary cases is confirmed that correspond with the reported results of researchers in other countries. .

Ethics

Hereby, I declare all ethical standards have been respected in preparation of the submitted article.

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