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# Occurrence of Vertical Fissure (Sand Crack) in a Holstein Heifer: A Case Report

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## ABSTRACT

The aim of the study reported here was to determine the clinical and morphopathological appearance of sever vertical fissure in a Holstein heifer. A 2.5 year old Holstein heifer was presented with lameness and abnormal weight bearing, for clinical evaluation in March 2010. The heifer was 7 months pregnant. The affected claw was more boxy than normal and the abaxial wall was convex in all directions. The solar surface of the affected claw was angled and bruised in zone 4. The lame cows used the heel region for weight bearing in standing and walking time. The heifer showed type 5 sand cracks. Based on the results the following conclusions were reached: (1) drinking water is analyzed for sulfate, iron, and nitrates, periodically, (2) Supplementing the diet of pregnant heifers in problem herds with biotin is recommended and (3) Management conditions such as poor drainage, accumulation of feces and urine on floors and overcrowding should be improved.

**Key words:** Heifer, sand crack, vertical fissure, management

## INTRODUCTION

Lameness in dairy cows is a serious welfare issue. It is a painful condition and causes economic losses (Esselmont and Kossaibati, 1997; Mohamadnia *et al*., 2008; Ghasemzadeh-Nava *et al*., 2007; Shams-Esfanabadi and Shirazi, 2006; Bozkurt *et al*., 2008; Sardari and Kazemi, 2008; Yaylak *et al*., 2009; Raof *et al*., 2011; Haghighat-Jahromi and Nahid, 2011). A vertical fissure is a split aligned in a vertical orientation on the dorsal wall of the claw. The fissure typically extends through the more superficial layers of the claw horn. The crack may originate at any level of the dorsal wall and extend distally for a variable distance (Greenough and Weaver, 1997). The economic significance of vertical fissures in cattle is unknown. Vertical fissures can result in severe lameness and is one of predisposing lesion for septic artritis (Greenough and Weaver, 1997; Greenough, 2007) and septic artritis is the most common reason for deep sepsis of a digital bones and premature culling (Nouri *et al*., 2007, 2008, 2011). The lesion is relatively common in western Canada. In a survey of 15 Alberta cow-calf herds, 37.2% of the cows were affected with one or more cracks (Westra, 1981). In another survey, it was reported that 1183 cows from 11 herds in Alberta had a prevalence of sand cracks of 22.7% (Hand *et al*., 1992). A random survey of 3615 cows in Saskatchewan demonstrated an overall prevalence of vertical fissures of 16.8% (Petrie *et al*., 1998). The lesions are most commonly seen in the lateral forelimb (Clark *et al*., 2004) of older (Goonewardene and Hand, 1995; Petrie *et al*., 1998) and heavier (Goonewardene and Hand, 1995) cattle. There is no published report on vertical fissure in Holstein heifer to the author' knowledge. The aim of the study reported here was to determine the clinical and morphopathologic appearance of sever vertical fissure in a Holstein heifer.

## CASE DESCRIPTION

A 2.5 year-old Holstein heifer was presented with lameness and abnormal weight bearing, for clinical evaluation in March 2010. The heifer was 7 month pregnant and was dried-off either at 7 months of pregnancy. The dairy herd of origin was in Nazarabad, Iran, with 400 milking cows and had no other incidents of vertical fissure in other heifer. The heifer was from a drylot dairy and fed a total-mixed ration. The diet consisted of alfalfa hay, corn silage and a commercial concentrate. Overcrowding, poor drainage and accumulation of feces and urine on floors and basis of the concrete bunk was obvious in this farm. The prevalence rate of claw fissure was 12.9% (Sand crack = 3.2% and Axial wall crack = 9.7%). The prevalence rate of claw lesion in the hind limb was higher than fore limb. The herd had endemic digital dermatitis with point prevalence in the adult herd of over 34/2%. This case was observed standing and walking (on a concrete surface whenever possible) using the Sprecher *et al.* (1997) scoring system and examined for detection of vertical fissure type (Greenough, 2001). In this case, sand crack affected the lateral hind claw. The affected claws were more boxy than normal and the abaxial wall was convex in all directions. The solar surface of the affected claw was angled and bruised in zone 4 (Fig. 1). The lame cows used the heel region for weight bearing in standing and walking time. The heifer showed type 5 sand cracks (Fig. 2).

## DISCUSSION

The causes of vertical fissures have not been determined, although contributing factors, such as trauma, laminitis, hoof size, trace element deficiencies and the mechanical stresses associated with horizontal growth arrest lines (Greenough and Weaver, 1997), dehydration and exacerbated by shear forces have been speculated upon. If a similar wide range were present among animals of the same body size, breed, and age, variations in claw volume could be a factor in determining whether or not the claw could sustain mechanical stress (Greenough, 2001; Clark *et al.*, 2004), such as this case on the herd level.

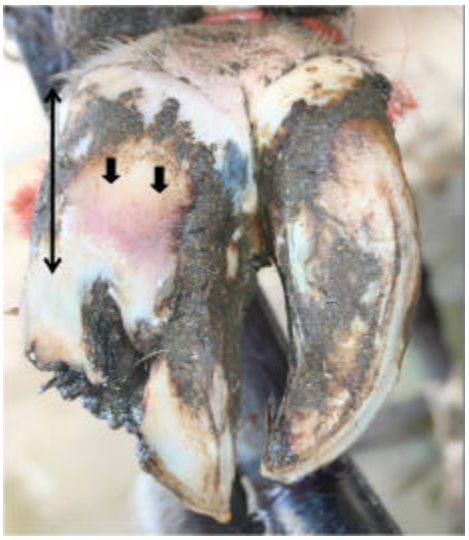

Fig. 1: The abaxial wall was convex in all directions. The solar surface of the affected claw was angled (double arrow) and marked hemorrhage in zone 4 (small black arrows) because of excessive weight bearing

Fig. 2: A type 5 sand crack involve only the central region of the claw, the result of mechanical stress from the dorsal flexure of the claw

Although, the incidence of this condition is high in mature Canadian beef cows (20%), the prevalence of lameness in affected cattle is low (Greenough, 2007). In this study, the prevalence rate of sand crack was more (3.2%) in dairy cows. There is a paucity of information on the risk factors associated with the development of vertical fissures. Westra (1981) found that no animals less than 1 years old had vertical fissures, but that the prevalence increased up to 5 years of age (59%) and then decreased thereafter. Petrie *et al.* (1998) also found that cows with vertical fissures were significantly older than unaffected animals. In addition, Goonewardene and Hand (1995) found that beef cows with sand cracks were 1.5 years older and were 43 kg heavier and fatter than cows that showed no lesions. In one herd, it was found that mature cows (second lactation and greater) with sand cracks were significantly heavier, with a mean body weight of 611.0 kg, compared with those without sand cracks, whose mean body weight was 597.3 kg (Greenough, 2001). All of these studies showed that the prevalence of vertical fissures was higher in older and heavier cows.

Except in the worst-affected herds, sand cracks are not seen in the claws of heifers during their first lactation. Even if an insult does occur during the first lactation, a horizontal groove would not emerge from beneath the coronary band for at least 2 months. The few sand cracks observed in first-lactation heifers involved only the coronary band (type 1 sand crack) (Greenough, 2001).

Vertical fissures were predominantly found on the lateral claw of the forelimbs in several other surveys (Westra, 1981; Hand *et al.*, 1992; Petrie *et al.*, 1998; Campbell *et al.*, 2000; Clark *et al.*, 2004). In this case, this finding does not agree with those of other workers. The reasons for this predilection are not obvious, but it is probably due to a biomechanical effect caused by weight

distribution and ground contact area (Hand *et al*., 1992) and differences in the size of medial and lateral claws, the degree of pronation or supination of the limb, or some other quirk of conformation (Greenough, 2001).

According to Greenough (2001), a vertical fissure is categorized as being one of several types: Type 5 sand cracks involve only the central region of the claw; these are not true cracks, but rather the result of mechanical stress from bending a curved surface, namely the dorsal flexure of the claw. Type 4 sand cracks are those that run from the center of the claw to the bearing surface. These are cracks that may be healing spontaneously and can be disregarded in a discussion of possible etiologies. If the most extensive sand cracks (type 3) and those in the healing phase (type 4) are discounted, one third of the sand cracks and disturbances involve the central region of the dorsal surface of the claw. Bending of the claw (concavity of the dorsal surface) usually occurs when a sand crack is present. It may be associated with a fault (horizontal fissures) or may occur because the tensile strength of the claw has diminished (Greenough, 2001).

In the course of study, the role of trace elements was investigated; Reports from veterinarians and suppliers of supplements indicate that the major criterion used by dairy producers to select a product was its low price. Although, much is known about the role of micronutrients, there is very little information available to guide producers or veterinarians regarding appropriate formulations.

Biotin is a factor in controlling the rate of production and deposition of proteins such as keratin, which is a component of skin, hair, and horn. Daily supplementation of the diet with biotin in dairy cows has been shown to increase the plasma concentrations of biotin and reduce lameness problems (Cooke and Brumby, 1982). A clinical trial showed that primiparous dairy cows supplemented with oral biotin had a decrease in prevalence of white line separation lesions (Midla *et al*., 1998). Studies have also demonstrated that the plasma concentration of biotin is lower in dairy cows with a history of lameness than in cows with no lameness (Roberts and Baggott, 1982). The possible association between diet and the formation of vertical fissures has received considerable attention (Hand *et al*., 1992; Campbell *et al*., 2000) and it would seem that if diet is a factor then it must influence the physical properties of the claw horn.

Longer term exposure to slurry (up to 14 day) can increase the size and depth of pre-existing cracks and fissures in poor quality hooves (Kempson *et al*., 1998) and this could lead to deeper invasion of harmful environmental and infectious agents, but it is not known whether this applies equally to water alone (Gregory *et al*., 2006).

## CONCLUSION

Based on the discussions the following conclusions were reached: (1) drinking water is analyzed for sulfate, iron, and nitrates, periodically, (2) supplementing the diet of pregnant heifers in problem herds with biotin is recommended and (3) management conditions such as poor drainage, accumulation of feces and urine on floors, and overcrowding should be improved.

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