

Vertebral Fractures in Newborn Calves

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Agerholm, J.S., A. Basse and J. Arnbjerg: Vertebral fractures in newborn calves. Acta vet. scand. 1993, 34, 379-384. – A prospective study on vertebral fractures in newborn calves is described. Vertebral fractures were found in 7.0% of necropsied calves of the Danish Holstein-Friesian (SDM) and Red Danish Dairy (RDM) breeds. Cases were not found in submitted calves of the Jersey breed or beef breeds. At least in beef breeds this was probably due to the low number necropsied. The rate of vertebral fractures in SDM and RDM breeds and between males and females were similar. Most cases occurred in calves born by heifers, and manual traction force had been applied in all cases. All fractures which in most cases consisted of a simple epiphysiolysis were located at the thoraco-lumbar area, and especially the posterior epiphysis of T13 was afflicted.

calf mortality; dystocia.

Introduction

A major problem in modern cattle production is the high frequency of stillborn calves and calves dying in the neonatal period. Most losses due to calf mortality are related to this period, and especially dystocia-related deaths are an important problem (Agerholm *et al.* 1993). A sequelae to dystocia is traumatic lesions which may afflict both soft tissues and the skeleton. Dystocia-related bone injuries affecting various parts of the skeleton, e.g. femur, mandible, and vertebral column have been described (Ferguson *et al.* 1990, Hamilton *et al.* 1978, Schuh & Killeen 1988, Trent & Ferguson 1985). Vertebral fractures (VF) have been observed as incidental findings in

several studies (Hamilton *et al.* 1978, Metzner & Weiler 1991, Smyth *et al.* 1992), but specific studies on this severe lesion have only been published few times (Jong & Reinders 1962, Schuh & Killeen 1988). The present study was performed to describe the frequency, epidemiology, and pathology of VF in newborn calves.

Materials and methods

The investigations were performed on calves submitted in a one-year study on calf mortality in Denmark. The materials and methods of this study have previously been outlined (Agerholm *et al.* 1993). During the first 2½ months of the study, necropsy was not performed with special regard on VF. Therefore, possible cases of VF might have been overlooked. However, a newborn recumbent Charolais calf with fracture of T13 (posterior epiphysis) was detected approx. 2 months af-

Note: A preliminary communication on this study has previously been published in Proc. XVI World Buiatrics Congr. 1990, vol. 2, 1065-1068.

Table 1. Breed distribution of 100 calves submitted for necropsy with special regard to vertebral fractures (VF) during 9½ months. SDM: Danish Holstein-Friesian, RDM: Red Danish Dairy breed.

	SDM	RDM	Jersey	Beef cattle	Total
Number of submitted calves	53	33	4	10	100
Number of submitted singleton calves	40	21	3	8	72
Number of calves with VF	4	2	0	0	6

ter the beginning of the study. This gave rise to a specific prospective search starting ½ month later and covering the last 9½ months of the period surveyed. Only calves submitted during these 9½ months are included in this article.

The calves examined with special regard to VF included stillborn calves, calves dying shortly after birth, and calves submitted with an anamnesis of locomotor disturbances. Submitted calves were necropsied. The necropsy procedures included examination of the peri-vertebral musculature for haemorrhage and longitudinal section of the vertebral column. Radiographic examination was performed on selected bones from calves with VF and control calves. The bones examined were limited to the right 5th rib and the vertebral column from the 10th thoracic to the 5th lumbar vertebra.

Table 2. Breed, sex, weight, and location of lesion in calves with vertebral fracture (VF).

SDM: Danish Holstein-Friesian, RDM: Red Danish Dairy breed, T: thoracic vertebra, L: lumbar vertebra, AE: Anterior epiphysis, PE: Posterior epiphysis.

Case	Breed	Sex	Weight (kg)	Location of VF
1	RDM	♀	35.6	T13, AE
2	SDM	♂	46.5	T13, PE
3	SDM	♂	41.3	T13, PE
4	SDM	♀	39.6	T12, PE
5	SDM	♀	38.0	T13, PE
6	RDM	♂	29.4	L2, AE

Histopathological examination of bones was performed on the distal epiphysis of the right 5th rib and on corpus vertebrae of T13 from both affected and unaffected calves. Bone samples were fixed in 10% neutral buffered formalin, decalcified with EDTA, paraffin embedded, sliced, and stained with haematoxylin and eosin. Histopathological examination on soft tissues and microbiological examinations were performed as previously described (Agerholm et al. 1993).

The rate of VF in different breeds was evaluated using chi-square-test, and the mean body weight of affected and not-affected calves were compared using *Student's t*-test.

Results

During the 9½ months studied a total of 100 calves were examined with special regard to VF, and 6 cases with antemortem fractures were found. All 6 calves were singletons and of either of the Danish Holstein-Friesian breed (SDM) or the Red Danish Dairy breed (RDM). Jersey calves and beef breed calves with VF were not detected. The frequency of VF among necropsied SDM and RDM calves could be calculated to 7.0%.

The rate of VF in SDM and RDM breeds was similar ($\chi^2 = 0.068$, $P > 50\%$), and the sex distribution of affected calves was equal (Table 2).

The mean body weight (MBW) of affected SDM and RDM calves was compared to the

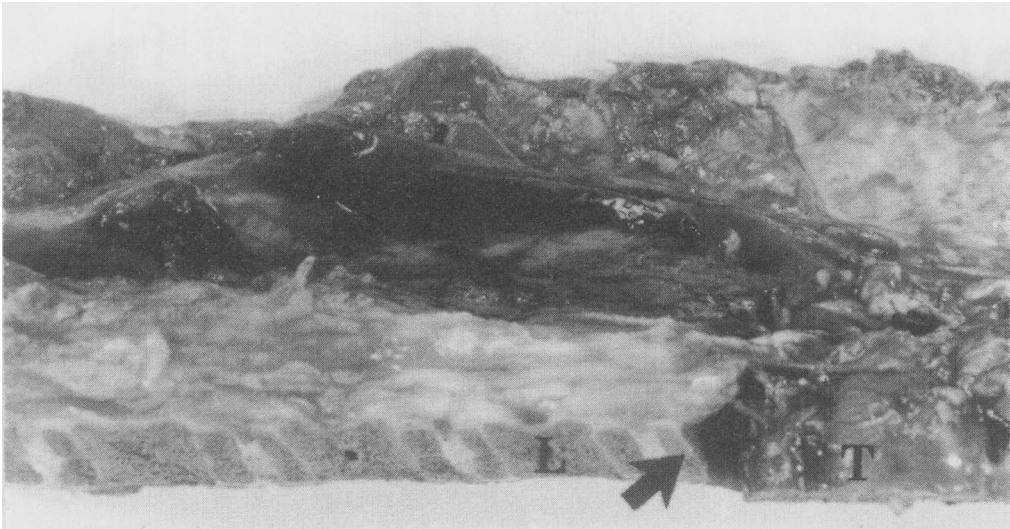


Figure 1. Acute severe haemorrhagia in the ventral column musculature at the thoraco-lumbar junction in a calf with vertebral fracture (arrow) (case 2). Columna vertebralis, pars thoracalis (T) and pars lumbalis (L).

MBW of other stillborn singleton calves of the same breeds. The difference was not found statistically significant.

The submitted calves with VF originated from 4 herds. Three affected calves were submitted from the largest herd in the study with approx. 340 cows while the remaining calves were submitted from 3 different herds consisting of 28, 75, and 234 cows, respectively.

Pedigree analysis showed that 2 calves were sired by 1 bull and 4 calves were sired by 4 other bulls. Inbreeding was not performed in any case.

Five calves with VF were born by heifers while 1 affected calf was born by a cow after 2nd pregnancy. This cow calved approx. 2 weeks before estimated date. The cow had a uterine torsion. Following retorsion, the calf was delivered through the birth canal.

Manual traction force had been applied in all cases of VF, and veterinary practitioners had participated in some cases. Mechanical trac-

tion force had not been used in any case. All 6 calves were stillborn or died shortly after delivery.

Necropsy findings

The only specific lesions found were directly related to the fracture. In ventral column musculature at the thoraco-lumbar junction an acute haemorrhage was always present (Fig. 1). The bleeding was in some cases restricted to the musculature at the fracture site while the bleeding was more severe in other cases. The bleeding was in all cases limited to the ventral column musculature while the dorsal musculature was never affected. Bleeding was present in the spinal meninges. When the musculature was removed a vertebral fracture could be observed. The exact location was determined on cutting the columna longitudinally at the midline. The fracture consisted in 5 cases of an epiphyseolysis affecting either T12 (17%) or T13 (67%) while in 1

case (number 6) the fracture was a combined epiphyseolysis and fracture afflicting L2 (Salter-Harris type II) (Kealy 1987). Multiple vertebral fractures were not observed. However, a tendency to postmortem fractures in the epiphyses around the thoraco-lumbar junction was observed in several cases of both calves with antemortem VF and stillborn calves without VF. In these calves small separations in the epiphyses were present, and fractures could be provoked by bending column with the hands. The necropsy findings were otherwise more or less unspecific. Three calves had total neonatal pulmonic atelectasis (NPA) and 3 had partial NPA. Common findings were oedema, congestion, and haemorrhage on the head, neck, and distal parts of the limbs. One calf (case 6) had a rupture of vena cava caudalis with excessive abdominal bleeding. The histopathological examination of soft tissues showed acute circulatory disturbances in several organs. Furthermore, aspirated meconium and squamous cells were present in the lungs in some cases. In the spinal meninges severe haemorrhage was observed. The examination of vertebrae showed acute bleeding without repair processes. Other pathological changes were not detected in neither the vertebrae nor the ribs.

Radiographic findings

The examinations confirmed the location of the fractures. The density of the examined bones seemed lower in calves with VF than in calves without. Furthermore, the compacta seemed thinner and less distinct in VF affected calves compared to control calves.

Microbiological findings

The organs of VF affected calves were either sterile or contained an unspecific coliform flora. Bovine virus diarrhoea virus or antibodies were not detected in any VF affected calf.

Discussion

Prospective studies on VF in calves have not been performed previously. Based on a retrospective survey *Schun & Killeen* (1988) suggested that VF in neonatal calves occurs infrequently. However, the present study showed that VF was a common lesion in stillborn calves occurring in 7.0% of calves dying in the perinatal period. VF was only diagnosed in singleton calves, but this seems to be fortuitous as VF has been observed in multiparous calves previously (*Jong & Reinders* 1962, *Schun & Killeen* 1988). In this prospective study only calves of the SDM and RDM breeds were diagnosed as having VF. This finding was also incidental as the calf which gave rise to the study was a Charolais calf. If the number of beef breed calves had been greater, cases probably would have occurred. Furthermore, *Schuh & Killeen* (1988) estimated that the incidence in beef calves and Holstein-Friesian calves was equal. The rate of VF for SDM and RDM calves was found to be equal. As these breeds both are dairy breeds, as the calves are of equal size, and as the 2 breeds are managed in the same way this observation fits well with the expected. A sex predilection was not observed, and this is in accordance with findings by *Schuh & Killeen* (1988).

Eighty-three per cent of calves affected by VF were born by heifers. This finding is in accordance with observations by *Schuh & Killeen* (1988) while *Jong & Reinders* (1962) found approx. equal numbers of affected calves born by heifers and cows. Forced extraction was used in all cases, and this is almost similar to other observations (*Schuh & Killeen* 1988). However, single cases in which traction force had not been applied, have been detected (*Schuh & Killeen* 1988, *Metzner & Weiler* 1991).

The pathological examination showed that

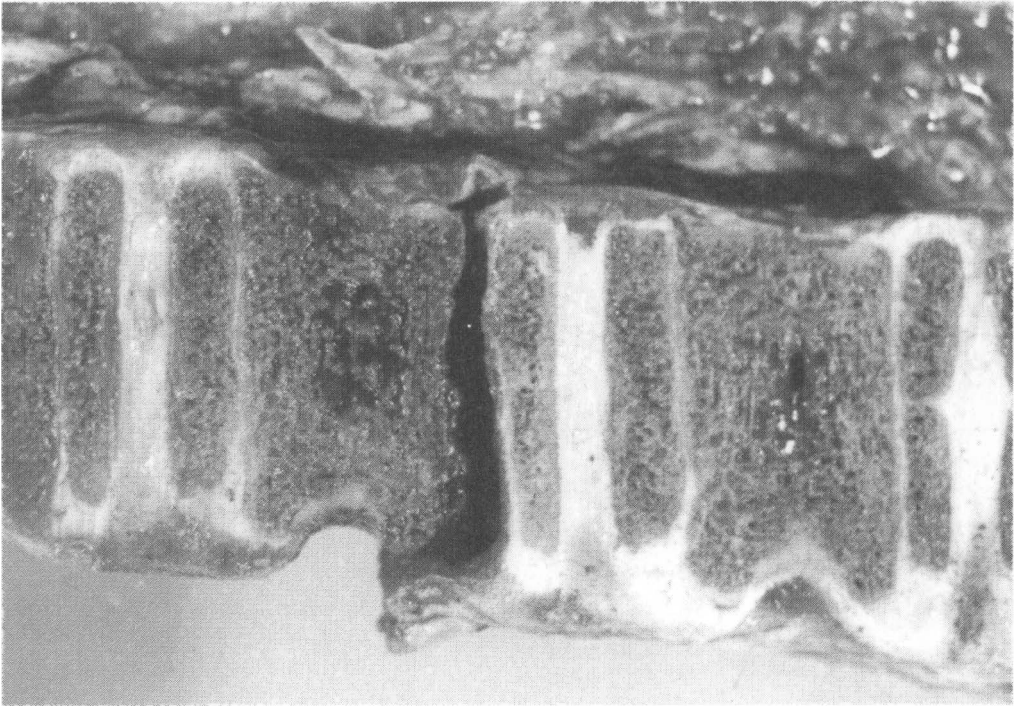


Figure 2. Vertebral fracture affecting the posterior epiphysis of the 13th thoracic vertebra (case 2).

there was a predilection for VF to be located at the thoraco-lumbar junction, and especially in the posterior epiphysis of T13. The fracture consisted in all cases of an epiphysiolysis which in one case was complicated by a fracture of corpus vertebrae. The location and fracture types were in accordance with other studies. *Jong & Reinders* (1962) found all fractures to be epiphysiolysis located in either T13 or L1 while *Schuh & Killeen* (1988) found 96% to be located between T12 and L3, and with 26% being located in the posterior epiphysis of T13. The lesions described by *Schuh & Killeen* (1988) consisted of fractures and/or luxations. In the present study, simple luxations were not observed. This was probably due to differences in the material exam-

ined in the 2 studies. Rupture of large abdominal vessels as observed in 1 case has previously been observed in connection to VF (*Jong & Reinders* 1962). Vertebral fractures can be overlooked at necropsy unless the pathologist is attentive to this lesion. As bleeding in the ventral column musculature at the thoraco-lumbar junction was present in all cases, examination of this area may be a useful and reliable indicator for the presence of antemortem VF. Other lesions which may draw the attention towards VF are haemorrhage around the kidneys, adrenal glands, and in peritoneum, and rupture of abdominal tissues.

The radiographic examination indicated that affected calves might have had a primary

bone disease. However, the examination was not conclusive, and bone changes others than fractures were not found at histopathology. The presence of a primary bone disease in calves with VF has been proposed previously (Jong & Reinders 1962), but an evidence has never been given. Therefore, further investigations must be performed before the presence of a primary bone disease can be included in the pathogenesis of VF in calves. Based on the present and previously studies it can be concluded that 1) Most cases of VF occur in calves born by heifers with dystocia, 2) The use of traction force is an important contributing factor, 3) There are no differences in the rate of affected males and females, and 4) The thoraco-lumbar area is predisposed for this type of fracture.

Acknowledgements

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Sammendrag

Fraktur af rygsøjlen hos nyfødte kalve.

En prospektiv undersøgelse vedrørende fraktur af rygsøjlen hos nyfødte kalve beskrives. Fraktur af vertebrae fandtes hos 7,0% af de obducerede kalve af racerne Sortbroget Dansk Malkerace (SDM) og Rød Dansk Malkerace (RDM). Tilfælde blev ikke fundet hos kalve af Jerseyracen eller af kødkvægsracer. For kødkvægets vedkommende, skyldtes dette sandsynligvis det lave antal obducerede kalve af disse racer. Der blev ikke fundet nogen forskel i frekvensen af vertebralfrakturer mellem SDM og RDM og mellem tyrekalve og kviekalve. De fleste tilfælde forekom hos kalve, der blev født af kvier, og i alle tilfælde var forceret fremtrækning anvendt. Alle frakturer fandtes i thoraco-lumbal området, og især den caudale epifyse af T13 var hyppigt fraktureret. I næsten alle tilfælde bestod frakturen i en simpel epifysiolyse.

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