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A case of congenital unilateral hip dysplasia in a newborn calf

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Summary

We describe the case of a Simmental calf with congenital unilateral hip dysplasia. In the initial physical exam, the calf was able to stand unsteady when helped and showed severe swinging lameness in the left hind limb. Unilateral hip laxity and a positive Ortolani sign indicated subluxation of the femur within the hip joint. This finding was further confirmed by radiographic examination which also showed malformation of the left femoral head and acetabulum. After a short period of clinical improvement the calf´s health deteriorated and it was euthanized due to signs of severe coxarthrosis. Pathological examination of the affected hip joint revealed a severe acetabular and femoral dysplasia with an incomplete formation of the epiphysis of the femoral head and a chronic granulating coxarthritis without evidence of primary infectious events.

Keywords: cattle, lameness, congenital, hip joint, dysplasia

Angeborene einseitige Hüftgelenksdysplasie als Lahmheitsursache bei einem Kalb

Es wird der Fall eines Kalbes der Rasse Simmental mit angeborener einseitiger Hüftgelenksdysplasie beschrieben. Das Kalb zeigte Aufstehprobleme, unsicheres Stehvermögen und eine hochgradige Hangbeinlahmheit in der linken Hintergliedmaße. Eine einseitige Gelenklockerung war mit Hilfe der Ortolaniprobe im linken Hüftgelenk nachzuweisen. Die röntgenologische Untersuchung bestätigte den Verdacht der Subluxation des linken Femurkopfes. Der mangelhafte Gelenkschluss ließ sich auch an der Abflachung des Azetabulums erkennen. Nach kurzfristiger Besserung verschlechterte sich die Lahmheit graduell und das Kalb musste wegen hochgradiger Coxarthrose der linken Hintergliedmaße eingeschläfert werden. Die histopathologische Untersuchung ergab eine einseitige Dysplasie des Azetabulums und Femurkopfes sowie eine unvollständige Ausbildung der Epiphyse des Femurkopfes. Eine chronische granulierende Coxarthritis ohne Anzeichen einer zuvor stattgefundenen Infektion wurde diagnostiziert.

Schlüsselwörter: Rind, Lahmheit, angeboren, Hüftgelenk, Dysplasie

Introduction

A 10-day-old, 36.4 kg male Simmental calf was presented to the Clinic for Ruminants of the Ludwig-Maximilians-University. The owners reported that the animal was able to stand when assisted but pronounced instability in the hind limbs was noted.

The calf was housed in a calf hutch right after birth, but was later placed in a deep-bedded box stall. The animal had been fed colostrum originating from the dam and subsequently received 2.5 liters of milk twice a day.

Clinical examination

At the time of initial examination, the calf was non-febrile with a rectal temperature of 39.4 °C (reference limits, 38.6 to 39.4 °C, Plumb, 2005). All vital signs were within normal limits. Serum biochemical abnormalities consisted of high creatinine kinase activity (337 U/l; reference range 35 to 280 U/l, Radostits et al., 2000). Thrombocytosis was the only abnormal parameter in the complete blood cell count (1774 G/l, reference range 100 to 800 G/l, Radostits et al., 2000). The umbilicus of the calf was normal with-

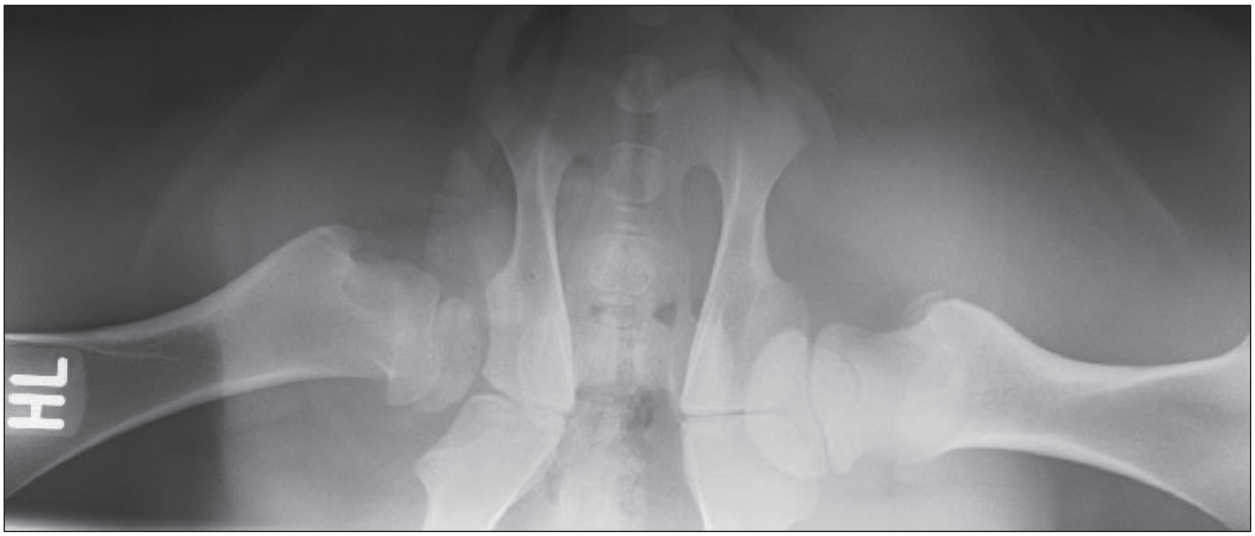

Figure 1: Ventrodorsal radiographic frog-leg view of the pelvis and both femoral heads of a 13-day-old male Simmental calf evaluated for a history of not being able to rise since birth. Note the difference in size and shape of the femoral head as well as the difference in concavity of the acetabulum. **HL**= left hind

out signs of inflammation or infection both extra- and intraabdominally. Blood testing for BVDV antigen and antibodies yielded negative results. During orthopedic examination, we noted an abnormally large range of motion in the left hind leg. Atrophy of the muscles of the same hind leg, most severe in the gluteal region, was present. We also found a pronounced laxity of the left hip joint with a positive Ortolani sign. When assisted into a standing position, the patient supported weight on both front legs as well as on the right hind leg. The left hind leg was always adducted and positioned forward. The calf exhibited no obvious signs of pain during examination. None of the palpable joints showed signs of arthritis.

Radiographic examination confirmed subluxation and malformation of the left hip joint with both the femoral head as well as the acetabulum being abnormally shaped (Fig. 1). The tentative diagnosis at this point was unilateral hip malformation causing permanent subluxation of the femoral head within the hip joint.

Therapy

Treatment begun with meloxicam (20 mg/ml; 0.5 mg/kg, SC, Metacam®; Boehringer Ingelheim); the calf also received a dose of a combined vitamin E and selenium solution (100 mg/ml alpha-tocopherolacetate, 1 mg/ml sodium selenite, 1 ml/10 kg, SC, Vitamin E/Selen-Lösung®; cp-pharma) at the time of the initial presentation. Physical therapy was initiated which consisted of assisting the animal to stand up several times daily as well as exercises to encourage walking. Ten days after admission the calf was able to stand up alone; shortly thereafter it started to walk and even frolic although lameness was still present. The owner decided to observe the calf´s progress at home and fatten it to be slaughterered. Therefore no further diagnostic tests were carried out.

Clinical course and further diagnostics

Seven weeks after the initial presentation, the patient was brought to the Clinic for Ruminants a second time because it showed stunted growth and was still lame in the left hind leg. Muscle atrophy was more pronounced when compared to the first findings. Hip laxity was present, crepitus could be appreciated in the left hip joint when the femur was rotated and abducted, and the Ortolani sign was still positive. All vital signs and evaluated blood parameters were within normal limits. Blood testing for BVDV antigen and antibodies was negative.

Radiographs were repeated and showed shallowness of the acetabulum, flattening and subluxation of the head of the femur as well as signs of severe osteoarthritis (Fig. 2). Because of a poor prognosis no further treatment was undertaken. Out of scientific interest control radiographs as well as a CT and MRI scan (including contrast enhancement MRI) were performed on the anaesthetized animal in the Clinic of Small Animal Surgery and Reproduction of the University. Intravenous administration of pentobarbital (300 mg/ml; 60 mg/kg, Release®; WDT) was used for euthanasia immediately after the diagnostic tests were completed. Radiography and CT revealed osteolysis and subchondral bone defects of the femoral head and acetabulum as well as reduction in size of the epiphysis of the head of the femur. Additionally, severe effusion of the left hip joint and thickening of the joint capsule were apparent in the MRI scan.

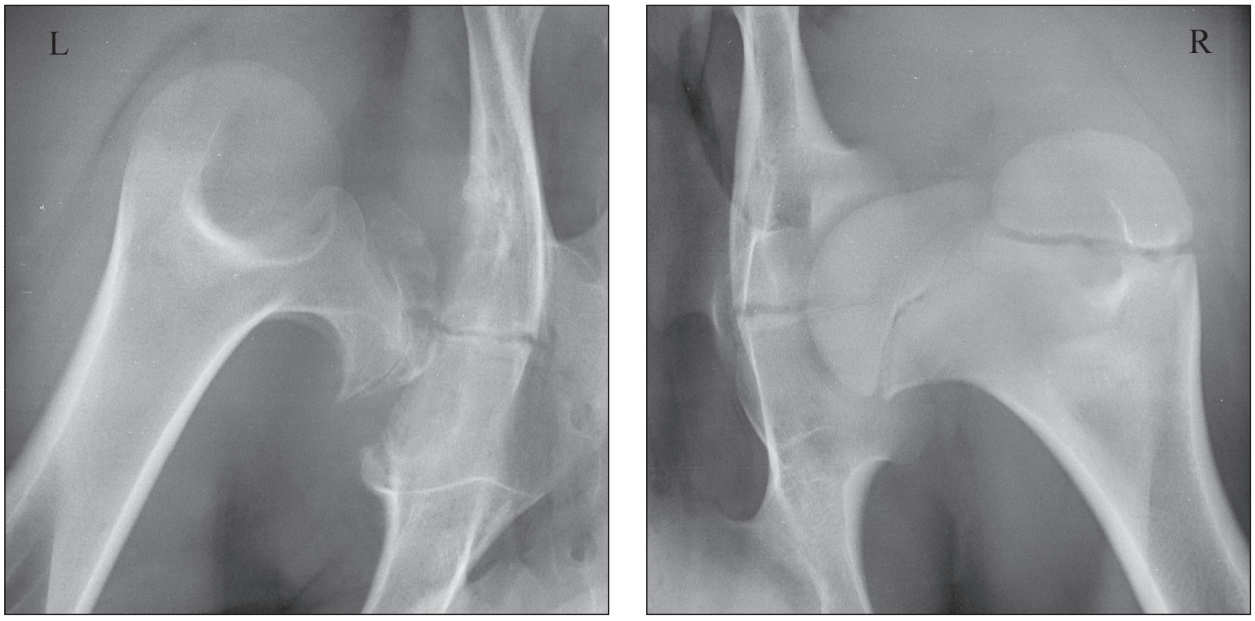

Figure 2: Ventrodorsal radiographic view comparing the left (L; **A**) and right (R; **B**) hip joint of the same calf at 3 months of age evaluated for chronic left hind limb lameness. Severe signs of osteoarthritis, absence of the bony acetabular rim and subluxation of the femur within the left hip joint can be appreciated. Osteolytic defects both in the left acetabulum and head of the femur are visible.

Necropsy and histology

The unaffected right hip joint displayed a regular anatomy and histological configuration (Fig. 3 A, B, E, G). The synovial fluid of the left hip joint was severely increased, of red-brown colour and clear appearance. Bacterial culture of the synovial fluid was negative. Further analysis of the synovial fluid yielded the following results: 16 600 nucleated cell count /µl; 15 300 polymorphonuclear (PMN) cells/µl; total protein 37 g/l; specific gravity 1.023 mg/ml. Grossly, the joint capsule was extensively thickenend and exhibited pronounced proliferation of the synovial membrane. The articular cartilage of the femoral head and the acetabulum displayed a blear beige colour and multifocal profound laminar erosions (~ 4 x 2 cm) with irregularly crenated margins. The ligament of the head of the femur was undiscoverable. Longitudinal sections of the acetabulum and the proximal part of the femoral bone revealed a severe malformation of the joint´s architecture. The acetabular fossa exhibited a flattened shape and multifocal marginal exostoses. The epiphysis of the femoral head was poorly developed and partially incomplete (Fig. 3 C, D). Histopathological examination revealed a severe chronic granulating coxarthritis with extensive proliferation of the synovial membrance and a marked increase in the thickness of the collagenous connective tissure of the joint capsule. The articular cartilage of the femoral head and the acetabulum was incomplete, displayed an irregular thickness and was partially replaced by chronically inflamed connective tissue with attendance of scattered neutrophils (Fig. F, H). However, no evidence of a bacterial infection could be detected using special stains. In areas with incomplete formation of the femoral head epiphysis, the metaphyseal ossification zone of the growth plate of the femoral head displayed an irregular organization with broadened medullary spaces between remnants of bone trabeculae. Similar alterations of bone architecture were evident in locations with missing cartilaginous coverage of the articular surface of the acetabulum (Fig. 3 F, H). However, in areas with a developed femoral head epiphysis, the growth plate and the adjacent ossification zones largely displayed an unaltered architecture. Based on these findings, a severe coxarthrosis with acetabular dysplasia, incomplete formation of the femoral head epiphysis and subsequent chronic granulating coxarthritis was diagnosed.

Discussion

We present the case of a unilateral malformation of the hip in a newborn calf leading to severe coxarthrosis. Few reports of hip dysplasia in beef breeds have been published previously (Howlett, 1972; Weaver 1978; Agerholm and Basse, 1993). All of these authors describe bilateral clinical signs in male calves almost identical to the present case with the difference that in this animal disease was confined to the left hip only. Although in most species affected individuals show no visible signs of the malformation in the first days or weeks of life, calves may be affected at birth (Weaver, 1978). Nevertheless, no description of unilateral hip dysplasia can be found in the litera-

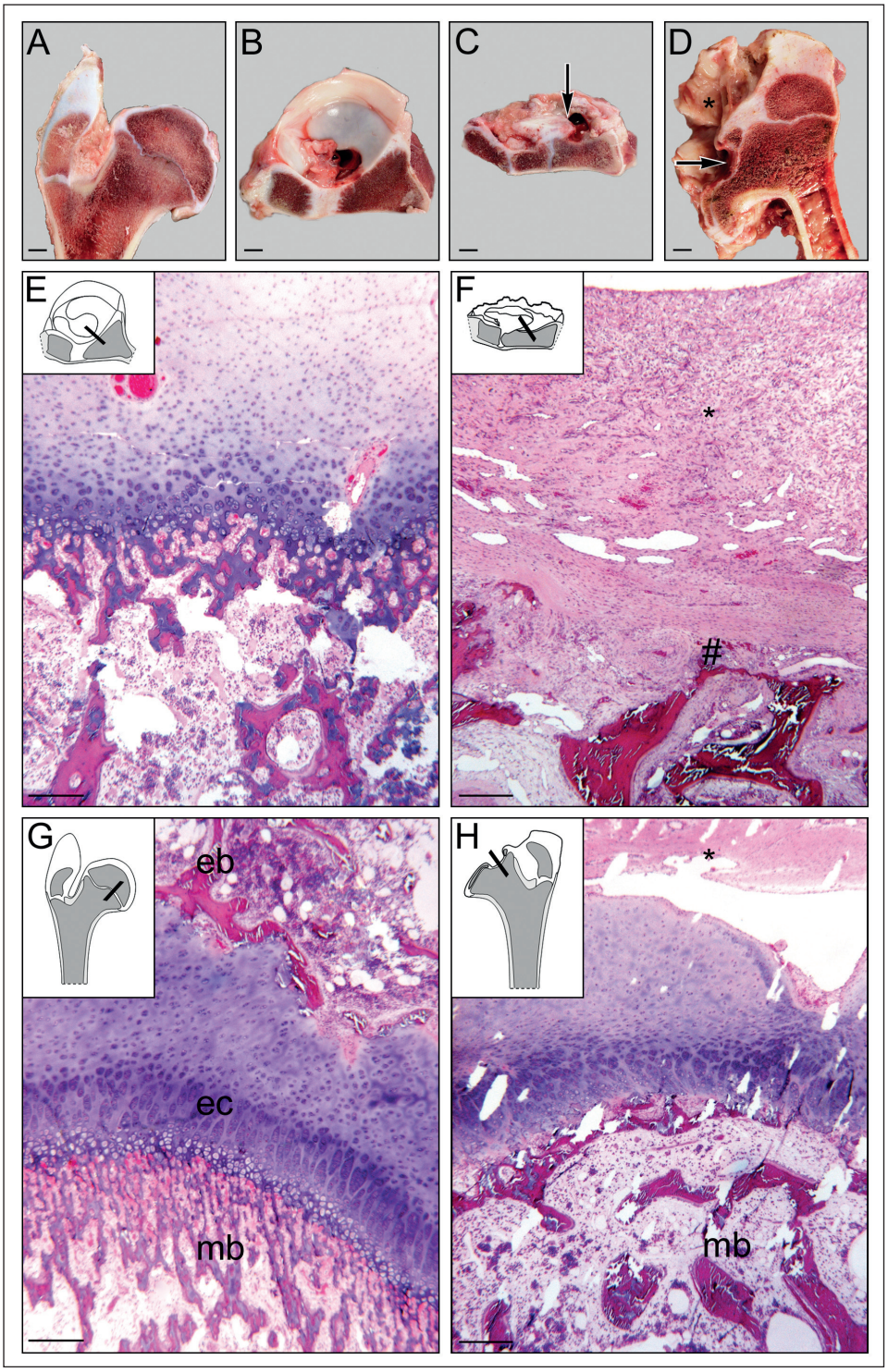

Figure 3: Gross and histopathological findings. **A-D**: Longitudinal sections of the femoral bones and acetabula. Bar = 0.5 cm. **A, B**: Regular anatomy of the right (healthy) hip joint. **C, D**: Diseased left hip joint. Extensively thickened joint capsule (asterisk) and profound laminar erosions of the articular cartilage (arrow). Note the incomplete dysplastic development and partial absence of the epiphysis of the femoral head. **E-H**: Histology. Plastic sections (Hermanns and others 1981). Hematoxylin and eosin staining. Bar= 200 µm. Schematic diagrams indicate the position and orientation of the sections. **E, G**: Regular histology of the articular cartilage and subcartilaginous bone of the acetabulum (**E**), and the growth plate of the femoral head epiphysis (**G**) of the healthy right hip joint. **eb**: Bone of the femoral head epiphysis. **ec**: Cartilage of the growth plate. **mb**: Metaphyseal ossification zone. **F, H**: Histopathology of the diseased left acetabulum (**F**) and femoral head (**H**). Replacement of cartilage by chronically inflamed granulation tissue (asterisk). **F**: Irregular organization of the subcartilaginous bone of the acetabulum (#). **H**: Section of the femoral head in an area with incomplete formation of the femoral head epiphysis. Irregular organization of the metaphyseal ossification zone (**mb**) with broadened medullary spaces between remnants of trabeculae.

ture and little is known about the etiology of hip dysplasia in cattle which may be different from the dog where the disease does not seem to be congenital (Henricson et al., 1966). Unilateral hip dysplasia in the calf described here might therefore be the result of malformation of the femoral head following epiphyseal malformation. This may lead to the head of the femur being smaller and not exerting enough pressure on the acetabulum resulting in acetabular dysplasia, subluxation of the left hip joint and secondary osteoarthritic changes.

Differential diagnoses of the primary condition included traumatic luxation of the femur, septic arthritis, osteochondrosis or epiphysiolysis of the femoral head. We cannot rule out completely the possibility of a primary septic arthritis when taking into account that joint laxity was present at time of first examination and radiographic confirmation of a malformation of the hip joint was confirmed at a very early stage the possibility of a septic arthritis seems far less likely, more so as typical clinical signs such as pain and swelling in the affected joint were missing (Greenough et al., 1991).

For this condition no treatment is described. Since we lack in depth information about the development of the neonatal hip in cattle, we cannot be sure if this malformation may be present to a lesser extent in other calves seemingly normal. In case of doubt, radiographic results can be compared with normal findings, for example in a digital roentgen atlas (Geissbühler et al., 2010). Our report indicates that the condition described above serves as a valid differential diagnosis for upper hind limb lameness and that its prevalence in our cattle population is unknown so far.

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