

# Clinical and gross pathological findings of congenital spina bifida and sacrococcygeal agenesis in an Omani crossbred calf

Somasundaram Mathan Kumar, Eugene Harper Johnson, Mohamed Hasan Tageldin and Ravi Padmanaban<sup>1</sup>

College of Agricultural and Marine Sciences, Sultan Qaboos University, Sultanate of Oman;

1. Veterinary Surgeon, Private Farm, Wilayat of Barka, Oman

Corresponding author: Somasundaram Mathan Kumar, email: mathan@squ.edu.om

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## Abstract

The objective of this case report was to describe the gross post-mortem findings of a rare clinical case of spina bifida and congenital sacrococcygeal agenesis in an Omani cross-bred calf. A three week-old Omani female cross-bred calf was recumbent at birth. Clinical examination revealed that the calf was mentally alert, but exhibited stiff and extended pelvic limb joints. The pectoral limbs were apparently normal. The calf had a fistulated circular excrescence in the skin (three centimeter in diameter) on the dorsal midline region of sacral region. The area surrounding the excrescence was void of hair. The calf also did not have a tail. Upon clinical consideration of the prolonged recumbency and suspected congenital skeletal defect, the calf underwent euthanasia. The observed gross post-mortem findings of the present case study were spina bifida, anury, partial sacral agenesis, scoliosis, misshapen ilium and a narrow pelvic canal. No abnormalities in the caudal abdominal organs were found. To the best of our knowledge this is the first reported case of spina bifida and sacrococcygeal agenesis in an Omani cross-bred calf.

**Keywords:** anury, Omani cross-bred calf, partial sacral agenesis, sacrocaudal agenesis, spina bifida

## Introduction

Congenital defects are reported worldwide in all breeds of cattle with varying occurrence and are of economic importance. Spina bifida or rachischisis is characterized by the absence of dorsal portions of vertebrae or vertebral arches commonly in the lumbar or sacral region and are often accompanied with defective rear limbs, tail and paralysis of the rear parts [1]. Spina bifida, an infrequent congenital defect refers to defective closure of dorsal vertebral laminae and lesions associated with this defect may vary in severity [2]. Congenital taillessness in calves may occur as a result of inheritance and are observed with *Atresia ani* or other urogenital anomalies [3]. It has also been reported in a day old male camel calf in combination with *Atresia ani* [4]. Although partial or complete absence of lumbar, sacral and coccygeal vertebrae and taillessness have been reported in calves, there appears to be a scarcity of information regarding agenesis limited to the sacrum and coccygeal vertebrae.

This condition however has been described in Manx cats [5] and Swiss mice [6]. The present case report describes the clinical and gross post-mortem findings observed in a three week-old Omani cross-bred calf with spina bifida and sacrococcygeal agenesis.

## Case presentation

### A three week-old Omani female cross-bred calf

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(Australian Zebu x Omani) given birth to by an apparently healthy dam was recumbent since birth. The dam had previously given birth to two normal calves. When assisted to its feet, the calf was able to nurse its mother for a few minutes and suckle from a bottle. Clinical examination revealed that it could not stand on its hind limbs, had stiffness in both pelvic limbs and extension of all joints, however with apparently normal pectoral limbs. There were no signs of ankylosis or arthritis. It was able to walk a few metres using its forelimbs if supported by elevating its hindquarters. Clinically, remarkable was caudal vertebral agenesis and a fistulated excrescence at the sacral region. The fistulated circular excrescence in the skin (three centimeter in diameter) was on the dorsal midline region of sacral region (Fig.1). An area of alopecia was observed extending caudally from the excrescence. The calf had a moderately distended abdomen with urinary incontinence and pasty feces smeared on the rectum. A congenital anomaly involving the caudal vertebra and the surrounding soft tissue was suspected. The calf underwent euthanasia.

Upon dissection of the skin, the excrescence led to an oval opening into the vertebral canal at the level of second sacral vertebrae (Fig.2). Noteworthy, were the complete absence of coccygeal vertebrae and sacral vertebrae beyond S2 and with scoliosis at the sacral level. (Fig.3). At the thoracic and lumbar levels the spinal column was normal. Despite the skeletal defects, no structural abnormalities of any of the caudal abdominal organs were observed (Fig. 4). The wing of the ilium was misshapen and there was a pronounced



Figure-1. Recumbent calf with caudal agenesis, excrescence, alopecia and urinary incontinence

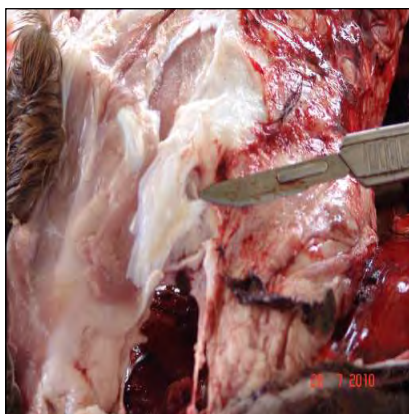


Figure-2. The skin underlying the excrescence led to an oval opening into the vertebral canal at the level of second sacral vertebrae (As pointed by a surgical scalpel)



Figure-3. Dorsal view of caudal spine indicating fistula and scoliosis



Figure-4. Caudal abdominal organs without any structural abnormalities such as normal ovaries, uterine horns, urinary bladder, and rectum

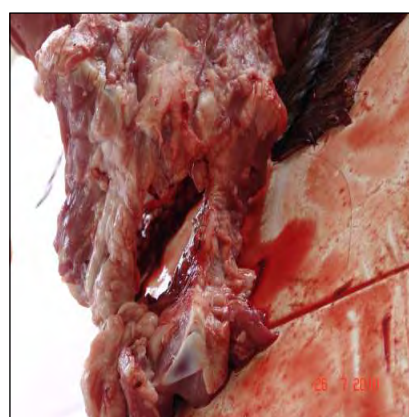


Figure-5. Misshapen ilium and narrow pelvic canal

narrowing of the pelvic canal (Fig 5). A diagnosis of concurrent occurrence of spina bifida and sacrococcygeal agenesis was made.

#### Discussion

Skeletal malformations especially anomalies involving the spine are among the most commonly recognized congenital anomalies of cattle [7]. A case of spina bifida was observed in a full term, still born male Hereford Calf [2]. It exhibited skin excrescence at the caudal sacral region, arthrogryposis, malaligned sacral vertebrae and fused kidneys. The calf in the present study was observed with skin excrescence, compatible with the spina bifida. However, unlike the findings of Doige [2], the calf in the present study exhibited partial sacral agenesis, anury and the absence of caudal abdominal organ anomalies. Partial or complete absence of the sacrum and the complete absence of the coccygeal vertebrae without involvement of the lumbar vertebrae has not been previously reported in calves. *Perosomus elumbis* is described as a congenital spine anomaly in which there is an absence of lumbar, sacral and coccygeal vertebrae. It is often complicated with arthrogryposis and has been reported in cattle, sheep, and several other species [1,7,8,9]. However,

the calf in the present case study did not exhibit arthrogryposis. *Perosomus audatus* is the absence of caudal vertebrae causing shortening or absence of the tail [1]. Typically, these conditions are associated with a variety of accompanying abnormalities of the gastrointestinal or urinary tract. A series of pathological abnormalities seen in calves with *Perosomus elumbis*, include: *atresia ani*, renal agenesis, intestinal malformations, cryptorchidism, testicular agenesis, vestigial penis, inguinal hernia, and vascular, vaginal and vestibular malformations as described in a review of the literature [8].

Similarly, a case of *Perosomus elumbis* accompanied with imperforate anus and a recto-urethral fistula [10]. A varied number of anomalies observed in three calves with coccygeal agenesis. These included persistent cloaca, incomplete development of the anus, absence of penis within the prepuce, absence of testicles and urethra and hypoplastic kidneys [11]. Lotfi and Shahryar [12], reported a case of taillessness in an Iranian crossbred calf with a clear skin excrescence at the point where the tail erupts. Although they considered it to be rare to observe taillessness without rectal abnormalities, the calf in the present study exhibited taillessness without any rectal

abnormalities.

In the present case, in addition to sacrococcygeal agenesis, scoliosis was observed at the level of the second sacral vertebrae and is concomitant with the description of vertebral agenesis accompanied with scoliosis [7]. The absence of the sacrum and coccygeal vertebrae has been described as the cause of the ala of the ilium to modify its shape, resulting in a deviation of the caudal spine [9,13]. The observation of stiffness of the pelvic limbs and the resulted recumbency could possibly be attributed to the contracture of the associated musculature and fixation of joints due to the consequence of tightness of the joints and interlocking of the articular surfaces [2,10].

The causes of sacro caudal agenesis have not been elucidated. However, morphogenesis and normal cellular differentiation must follow a highly synchronized pattern of gene expression and regulation [8]. Disorders during the tail-bud stage development, might allow the malformation of the neural tube or improper migration to accompany partial agenesis of the caudal spinal cord. Abnormal development usually occurs in the foetus when genetic and environmental insults overwhelm the foetal compensatory mechanisms. Genetic defects can originate from the dam, sire or both. Environmental teratogens including nutritional deficiencies and excesses, chemicals, drugs and biotoxins are also potential causes of skeletal deformities. [9]. A deficiency of manganese in pregnant females has long been known to cause skeletal defects in the offspring of various species [13]. Bovine inbreeding has also contributed to an increase in the number of congenital defects observed in this species. In the present case, sire information was unavailable, as bulls and cows were housed together and proper breeding records were not maintained. Another possibility is that such defects may be caused by chromosomal mutation in the Homeobox gene family [10]. Although the aetiology of this congenital defect remains undetermined, inherited chromosomal mutations, an intake of different xenobiotics, and/or a disturbed metabolism of the cow may have caused the defect.

To the best of our knowledge this is the first report of a combination of spina bifida and congenital sacrococcygeal agenesis in a calf. Unfortunately, the observations described at the present paper were performed under field conditions. This precluded the possibility of performing X ray analysis of the specimen or macerating the bone specimens to study

the bone anomalies in detail as described by Driesch [14]. However, the findings of the case were clearly compatible with spina bifida and sacrococcygeal agenesis. The fact that the calf was able to suckle, was not still born and exhibited no other caudal abdominal or urogenital anomalies clearly illustrates the uniqueness of this case.

Competing interests

Authors declare that they have no competing interest.

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