Introduction

Diseases of the tail are common in cattle (3, 4). Infection or necrosis of the tail tip, injury of the coccygeal vertebrae resulting in tail paralysis (8, 12) as well as fracture or luxation of the coccygeal vertebrae (6) are some of the most common disorders. Congenital defects, diskospondylitis and tumours of the tail occur occasionally (5, 8).

Tail fractures or luxations are usually the result of trauma, such as falls, excessive traction on the tail when moving a downer cow, excessive traction on a calf during assisted delivery, and mounting by other cows or heavy bulls (3, 13). Clinical signs depend on the severity of nerve damage and the location of the fracture. Fractures involving the second (S2), third and fourth sacral (S3 and S4) segments may affect the pudendal nerve, pelvic nerves and the tail nerve resulting in paralysis of the urinary bladder, anus and tail. Tail paralysis without other neurological deficits indicates damage to the coccygeal nerve (7).

Diseases of the tail may be treated conservatively or by amputation cranial to the affected area. Tail amputation in cattle is a very controversial subject because in some countries, it is carried out prophylactically for management reasons without any medical indication (1, 9, 11). Prophylactic tail amputation is done 7–8 cm below the vulva in calves and 5–6 cm below the vulva in heifers and mature cows. The present case report describes complete amputation of the tail at the level of the sacrum in a cow with osteomyelitis of the first (C1) and second coccygeal (C2) vertebrae.

Case history

History

A 3.5-year-old German Fleckvieh cow was referred to our clinic because of limited tail movement and a non-healing wound on the tail head. The cow was a valuable breeding animal and 8 months pregnant. Four weeks before referral, a small round wound with purulent exudate was noticed on the tail head and was treated with antibiotics locally and systemically. The amount of exudate increased markedly over the following 4 weeks and there was no response to local antibiotics and lavage of the fistulous tract.

Clinical and radiographical examination

Except for the wound on the tail head, the results of a physical examination were unremarkable and haematological and biochemical analyses were within normal limits. The fistula and purulent exudate on the tail head were readily apparent. Caudal to the fistula there was a deviation in the contour of the tail head (Fig. 1). The tail was held slightly to the right at the level of the tail head, and the cow could not completely lift the tail during defecation and urination, which resulted in soiling of the tip of the tail. There was reduced tail tone, and passive movement of the tail elicited pain. Anal tone and the anal reflex were normal. A probe...
could be advanced approximately 10 cm ventrally into the fistulous tract. A deviation in the coccygeal vertebral column and instability in the region of S1 and S2 were also detected by transrectal palpation.

Radiography (Fig. 2) revealed osteomyelitis of C1 and C2 with complete destruction of the intervertebral disc and showed a ventral luxation of the vertebral column at this location. Based on all the findings, a diagnosis of osteomyelitis of C1 and C2, infection of the associated intervertebral disc and luxation of C2 was made.

**Treatment and outcome**

Because of a poor response to conservative treatment and risk of rupture of the abscess into the rectum, pelvic cavity or spinal cord, complete amputation of the tail and affected tissues was carried out with the owner’s consent. The operation was done with the cow standing because of advanced pregnancy. The cow was sedated with 0.01 mg xylazine administered intravenously and her head and body secured to a hydraulic tilt table. Hobbles were placed on the hind limbs. Epidural anaesthesia using 10 ml of 2% procaine solution was carried out between S5 and C1. Additionally a total of 100 ml of 2% procaine solution per side was injected in the region of the second last sacral segment, lateral to the spinous processes and subcutaneously over the spinous processes to desensitize the nerves of the skin and musculature. The local anaesthetic was effective for the entire duration of surgery, which was 2 hours. The cow remained standing and did not try to lie down at any time during the procedure.

After aseptic preparation and draping of the surgical site, an elliptical skin incision was made around the fistulous tract, which was then clamped in the subcutaneous tissues to prevent discharge of pus during the operation. The skin incision was extended along the median distally 10 cm to the tail folds (Fig. 3a). A circular incision around the tail was made at that point and the distal portion of the tail was amputated between C5 and C6. Excision of C5 to C1 was achieved by carefully dissecting close to the bones to preserve the sacrococcygeal muscles (dorsal, medial and lateral sacrococcygeal muscles, ventral sacrococcygeal muscle, coccygeal muscle) and prevent perforation of the rectum. Bleeding was controlled by cauterization or ligation of the vessels. Care was taken not to open the abscess cavity in the region of C1 and C2. Starting dorsally at the proximal aspect of the wound, the supraspinous ligament, interspinous muscle, intertransversal muscles and ventral sacrococcygeal muscles (2, 10), blood vessels and the caudal nerves were transected between S5 and C1. The intervertebral disk was cut dorsally and C1 to C5 were tipped ventrally away from the sacrum to allow identification and ligation of the middle sacral artery and vein. After ligation, the blood vessels were transected and C1 to C5 were removed. The wound was lavaged liberally with lactated Ringer’s solution containing penicillin, and the various muscles were sutured in five layers using USP 2 (3 metric) synthetic braided ab-

![Fig. 2 Laterolateral radiographic view of the tail head (S5 = fifth sacral segment) of a 3.5-year-old dairy cow with luxation of the second coccygeal vertebra (C2) and osteolysis of the first (C1) and second coccygeal vertebrae at the intervertebral space (A = location of abscess).](image_url)
sorbable suture material in a continuous suture pattern. The subcutaneous tissues were sutured with the same suture material but a smaller size (USP 0) (3.5 metric) using a horizontal mattress suture pattern. The skin was closed with USP 2 (5 metric) non-absorbable suture material using a single interrupted suture pattern.

Postoperatively, the cow received procaine penicillin (25000 IU/kg) intramuscularly every 24 hours for 7 days and ketoprofen (1.1 mg/kg) intramuscularly every 24 hours for 3 days. Other than mild swelling of the incisional area, which resolved within a week, there were no complications. The position of the anus and vulva remained normal (Fig. 3b). The cow was housed in a tie-stall for 15 days before being discharged from the clinic. During the last days of her hospital stay she was hand-walked and the sacrum was radiographed. Examination of video recordings of the cow’s gait showed no neurological deficits. Anal and perineal reflexes and skin sensitivity at the operative site were normal. Two weeks after discharge from the clinic, the cow calved without difficulty under veterinary supervision. In the following 6 months, embryos were collected from the cow on two occasions, after which time she was bred and conceived. The cow calved the third time at term without difficulty with the owner present. Daily milk production eight weeks post-calving (2010) was 45 litres.

Discussion

To the authors’ knowledge, amputation of the entire tail in cattle has not been reported. The procedure was indicated in our patient because conservative treatment had not resolved the infection and the cow had bilateral coccygeal nerve damage. Furthermore, there was a risk of pararectal abscess formation or ascending infection of the spinal cord. The musculature in the operative site was preserved as much as possible to protect the caudal pelvic tissues, particularly with respect to the impending parturition, and to protect the function of the rectal sphincter and vagina and the musculature dorsal to the rectum. The preparation of the coccygeal vertebrae was difficult because the first five coccygeal vertebrae have all the features of normal vertebral including transverse processes, and in addition they have ventral hemal processes. Because the cauda equina ends at the last sacral segment in cattle (2), only the coccygeal nerves, and not the pudendal branches of the perineum, were affected at the time of surgery. Thus, there was no loss of anal or perineal function before or after the operation. The loss of part of the dorsal attachment of the vagina and rectal sphincter did not result in urine pooling or abnormal defecation at any time during long-term follow-up evaluations. Fertility and calving were normal, which indicated that pelvic organ function was unaffected by surgery. In a telephone follow-up the owner reported that the cow was more pruritic than herd mates. The cow used the cow brush and other objects frequently to scratch her anal region, but had no evidence of ectoparasitism.

The aetiology of the infection was not identified. Haematogenous spread of infection causing diskospondylitis or infection of the tips of vertebral processes after blunt trauma (luxation), infection attributable to non-aseptic epidural anaesthesia or another sharp injury were possible causes. The surgical technique used in our patient appears suitable for treatment of diseases of the tail head, including infections and tumours.

Conflict of interest

The authors confirm that they do not have any conflict of interest.