

## Amputation of the Front Medial Digit of a Holstein Cow - Successful Parturition and Milk Production

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### ABSTRACT

**Background:** Diseases of the bovine digit and hoof remain major problems in dairy farming and the beef cow industry. Severe claudication accompanying swelling and pain at the lesion is often observed in deep digital sepsis, septic arthritis, severe sole ulcers, and chronic interdigital phlegmon. In addition, digital amputation is often performed in cases of white line disease or severe trauma, such as bone fractures. There are few reports of amputation of the medial digit of the bovine front hoof. In this case, amputation of the medial digit of the front leg of a pregnant cow was performed; its hospitalization and return to productivity is reported.

**Case:** The bovine was a 9-year-old Holstein cow in the 6<sup>th</sup> month of pregnancy, weighing 671 kg. Upon admission, the cow could not bear weight on its right front leg, and swelling and a purulent discharge were observed in the coronary area of the medial digit. X-ray examination results indicated a periosteal reaction centered on the 3<sup>rd</sup> phalanx of the medial digit of its right front leg hoof and slight periosteal reactions at the adaxial sides of the middle and proximal phalanges, strongly suggestive of septic arthritis caused by infection. According to the X-ray examination results, no abnormalities of the lateral digit of the front right hoof were observed; thus, it was estimated that the post-amputation hoof would be able to bear weight. Therefore, a decision was made to perform immediate amputation of the medial digit of the right front leg hoof to reduce pain for improved delivery of the offspring and improved milk production during the lactation period, rather than allowing the lesion progress until the dry period or the expected date of delivery. According to the X-ray examination results, amputation of the 1<sup>st</sup> phalanx alone was expected to suffice for removal of the cause of the pain; thus, a decision was made to perform amputation at the edge adjacent to the 2<sup>nd</sup> phalanx. The right front medial digit was prepared for aseptic surgery, and infiltration anesthesia was performed. An incision was made with a surgical knife at the interdigit of the right front limb. A wire saw was inserted into the site to cut the 2<sup>nd</sup> phalanx in the anti-axial direction down to the skin to resect the lesion. White viscous pus was discharged at the resection site; therefore, the wound was lavaged with tap water and packed with povidone iodine-impregnated gauze. The wound was also covered with a diaper and dressed with non-elastic and elastic bandages. The dressing was changed daily to aid wound healing. No problems were observed in the standing-up motion or other relevant movements immediately after the surgery. Granulation tissue formed rapidly, approximately 2 weeks after the surgery, and the lesion dried gradually. Approximately one month after the surgery, the subject exhibited little difficulty in both standing up and walking. The subject successfully delivered its 7<sup>th</sup> offspring at the farm on postoperative day 93.

**Discussion:** The animal of this study was a 9-year-old, pregnant cow, and although amputation of the front medial digit is a relatively rare procedure, the cow was able to deliver and return to production, owing to sufficient postoperative treatment and care. The case also demonstrated the advantage of X-ray examination in bovine hoof diseases for accurate diagnosis, precise operation, and prognostic assessment.

**Keywords:** bovine, lameness, surgery, septic arthritis, bovine hoof, medial digit, digital amputation.

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## INTRODUCTION

Diseases of the bovine digit and hoof remain problematic in dairy farming and the beef cow industry [9]. Severe claudication accompanied by swelling and pain at the lesion is often observed in deep digital sepsis, septic arthritis, severe sole ulcers, and chronic interdigital phlegmon. Maintenance of an effective local antibiotic drug concentration is challenging in cases of deep hoof infection, as the lesions are located in the bone or tendon sheath; hence, antibiotic administration alone is insufficient to control such an infection [5]. Claudication combined with severe pain suggests the spread of the bacterial infection, requiring removal of necrotic tissue and adequate drainage and washing. In addition, digital amputation is often performed in cases of white line disease or severe trauma. It is relatively simple in terms of technique and post-operative management. The procedure effectively reduces pain, prevents the spread of the infection, and contributes to the swift recovery of productivity [1]. Moreover, it does not reduce the cow's productivity or lifespan if proper postoperative care is implemented [7,8]. Digital amputation should be considered according to the potential postoperative economic efficiency. Suitable cows include those expected to maintain their productivity following the improvement in limb-weight balance and increased appetite, as well as aged cows with short productive lifespans and fattening cows scheduled for shipping [9].

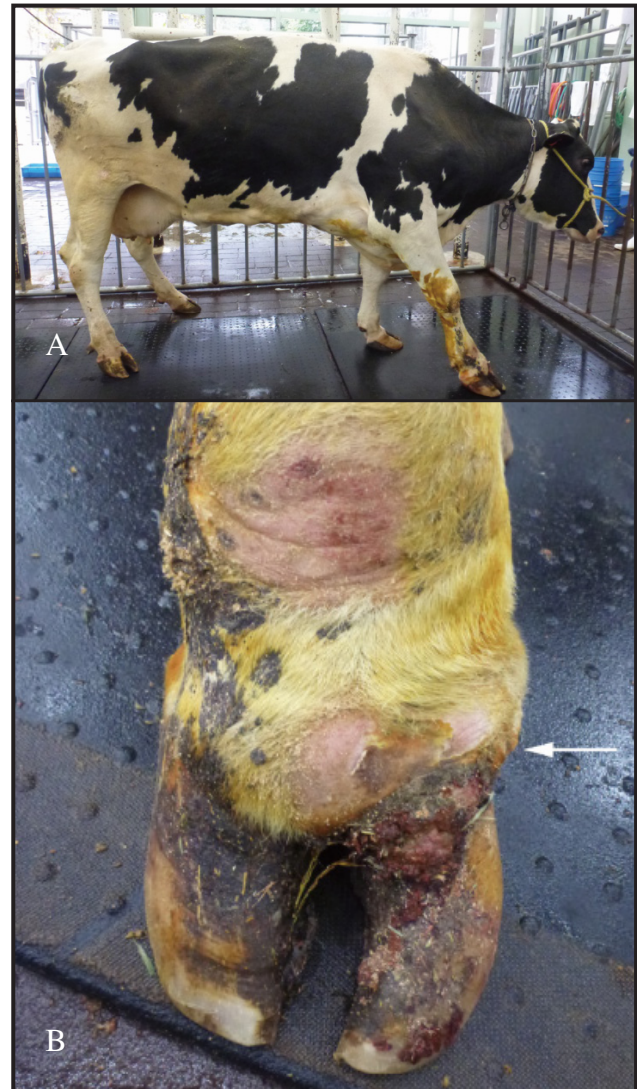
There are few reports of amputation of the medial digit of the bovine front hoof. Here, such an amputation on an aged cow during the 6<sup>th</sup> month of pregnancy. It successfully delivered and fed its calf.

## CASE

The bovine was a 9-year-old Holstein cow in the 6<sup>th</sup> month of pregnancy, weighing 671 kg. It exhibited swelling and pain of the hoof of its right front leg, which was unable to bear weight; the veterinarian on site suspected interdigital phlegmon or bone fracture at the coffin joint and treated it accordingly, without success. Thus, the cow was referred to the university hospital.

Upon admission, the cow could not bear weight on its right front leg, and swelling and a purulent discharge were observed in the coronary area of the medial digit (Figure 1). It could stand without any difficulty, exhibited a healthy appetite, and exhibited no symptoms suggestive of miscarriage. The X-ray examination results indicated an evident periosteal reaction, centered

on the 3<sup>rd</sup> phalanx of the medial digit of the right front leg, and slight periosteal reactions at the adaxial sides of the middle and proximal phalanges, strongly suggestive of septic arthritis caused by the infection (Figure 2A).



**Figure 1.** Cow with of 6 months of pregnancy. A- Cow's stance, avoiding pressure on the right front leg. B- Swelling in the coronary area of the medial digit.

*Staphylococcus aureus*, *Escherichia coli*, and *Trueperella pyogenes* were isolated via bacteriological examination of the discharged pus. At the time of admission, the blood test results exhibited relatively high values: a serum protein concentration of 8.2 g/dL, plasma fibrinogen concentration of 1,200 mg/dL, serum lactate dehydrogenase activity of 2,357 IU/L, and creatine kinase activity of 217 IU/L; however, no other abnormalities were detected. Although no signs of ulcers were observed at the hoof sole, the cow was

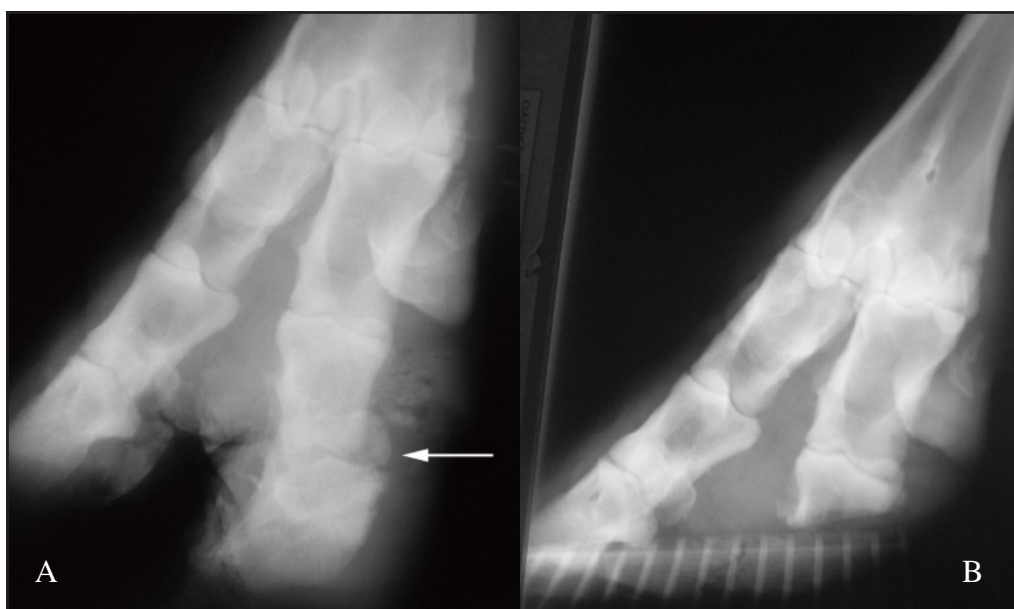
diagnosed with deep septic arthritis caused by trauma-induced bacterial infection. Upon X-ray examination, no abnormalities were detected at the lateral digit of the right front leg hoof; thus, it was estimated that the post-amputation hoof would be able to bear weight. Therefore, the decision was made to perform immediate amputation of the medial digit of the right front leg hoof to reduce pain for better delivery of the offspring and milk production during the lactation period, rather than allowing the lesion to progress until the dry period or the expected date of delivery. The X-ray examination results suggested that amputation of the 1<sup>st</sup> phalanx alone would suffice to remove the cause of the pain; thus, a decision was made to perform amputation at the edge adjacent to the 2<sup>nd</sup> phalanx.

Prior to surgery, penicillin G procaine<sup>1</sup> [10,000 U/kg body weight (BW)], intramuscular] was administered. The cow was supported in a standing posture to secure the affected leg, and 0.1 mg/kg body weight of xylazine<sup>2</sup> was administered intravenously to sedate the subject. The right front medial digit was prepared for aseptic surgery and a tourniquet was applied below the tarsus. However, intravenous administration of local anesthetic was impossible owing to swelling at the lesion; thus, anesthesia [60 mL of 2% procaine hydrochloride<sup>1</sup>] was infiltrated. An incision was made with a surgical knife in the interdigit of the right front limb. A wire saw was inserted into the site to cut the 2<sup>nd</sup> phalanx in the anti-axial direction down to the skin to resect the lesion. White, viscous pus was

discharged at the resection site (Figure 3A); therefore, the wound was lavaged with tap water and packed with povidone iodine<sup>4</sup>-impregnated gauze. The wound was also covered with a diaper and dressed with non-elastic and elastic bandages. The subject was administered penicillin G procaine<sup>1</sup> [5,000 U/kg BW, i.m.] for the week after surgery. The dressing of the amputation site was changed daily to optimize wound healing.

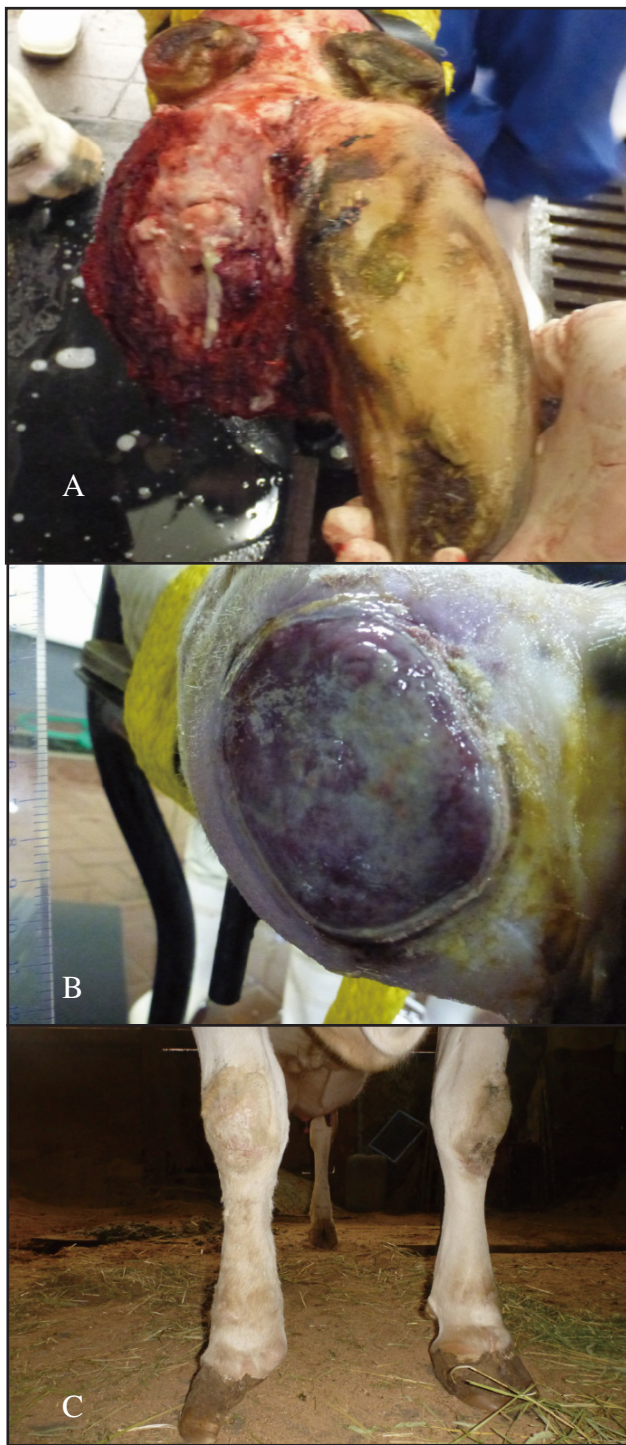
No problems were observed in the standing-up motion or other relevant movements immediately after the surgery. X-ray examination was conducted one week after the surgery; the result revealed no propagation of the periosteum, and the border between the bone and periosteum became clear, suggesting a decrease in the periosteal reaction (Figure 2B). This also indicated that amputation was successfully performed in the area adjacent to the 2<sup>nd</sup> phalanx, as planned. The amputated medial digit of the right front hoof was sterilized by boiling and rinsed to make a bone sample. X-ray examination of the sample revealed osteolysis near the 3<sup>rd</sup> phalanx (Figure 2C).

Granulation tissue formed rapidly, approximately 2 weeks after the surgery, and the lesion dried gradually. Approximately 1 month after the surgery, the subject exhibited little difficulty not only in standing up but also in walking. On postoperative day 38 (Figure 3B), the dressing was changed for the last time, and the treatment was successfully completed. The subject successfully delivered her 7<sup>th</sup> offspring at the farm on postoperative day 93. Figure 3C presents the lesion on postoperative day 123.



**Figure 2.** Affected lesion of the first phalanx of the medial digit of the front right hoof. A- X-ray image obtained before surgery. B- X-ray image obtained after the surgery. C- Processed bone sample of the affected region. Arrows indicate the periosteal reaction.





**Figure 3.** Digital amputation. Cow's hoof: A- Immediately after surgery. B- 38 days after surgery. C- 30 days after calving and 123 days after surgery.

## DISCUSSION

Several surgical treatments have been suggested for severe septic arthritis of the phalanges, some of which are reportedly more effective than digital amputation [3,6,11]. However, digital amputation remains widely used in clinical settings for various reasons,

including the relatively low cost of the operation and successful postoperative management.

The cow was 6 months pregnant, and immediate digital amputation was deemed the best solution to reduce its physical burden and the risk of miscarriage, and to improve its post-delivery productivity, rather than to perform long-term conservative treatment until its dry period or until delivery. Moreover, X-ray examination indicated a high probability of deep intraosseous infection, for which treatment such as systematic antibiotic administration has little effect. Deep digital sepsis often occurs in the lateral digit of the hind leg, and the prognosis of digital amputation performed at that site is not always favorable [10]. In this study, digital amputation was performed for idiopathic septic arthritis that occurred at the medial digit of the right front hoof. As a result, the cow yielded nearly the expected amount of milk without any substantial problems during postoperative management, the dry period, and the post-delivery period.

Although X-ray examination of the lesion is not mandatory, it is beneficial to confirm the presence of any abnormalities in the other digits that would affect their ability to support extra load after amputation of the affected digit, allowing veterinarians to determine the optimal amputation site. In addition, in this study, a bone sample was prepared from the amputated digit for visualization of the site of osteolysis as confirmation of the X-ray examination results.

Concerns have been raised regarding digital amputation performed by lay hoof trimmers, which is done because of the simplicity and effectiveness of the operation [2,4]. It is a well-established procedure; nevertheless, it must be performed not only based on precise diagnosis but also with sufficient consideration of intra- and postoperative pain management and rearing hygiene management. As the procedure is painful and irreversible, it must be performed by trained veterinarians to ensure animal welfare.

The animal of this study was a 9-year-old, pregnant cow, and, although amputation of the front medial digit is a relatively rare procedure, the subject was able to deliver and return to production, owing to sufficient postoperative treatment and care. This case also demonstrated the advantage of X-ray examination in bovine hoof diseases for accurate diagnosis, precise operation, and prognostic assessment.

MANUFACTURERS

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