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CASE REPORT
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Metacarpophalangeal Flexural Deformity in a Calf: Surgical Approach

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ABSTRACT

***Background*:** Flexural deformity is a condition often caused by the contracture of the superficial digital flexor tendon (SDFT) and/or deep digital flexor tendon (DDFT), which can affect the carpal, metacarpophalangeal, and distal interphalangeal joints, significantly interfering with locomotion and normal development in affected calves. Several factors are associated with this condition, which can be classified as mild, moderate, or severe. Diagnosis is made through clinical and radiographic examination. Treatment may vary between conservative and surgical approaches, depending on the severity of the deformity. Calves with severe deformities may not respond to treatment and often require euthanasia. This article aims to report the surgical treatment of bilateral metacarpophalangeal flexural deformity in a calf.

***Case*:** A 9-day-old male mixed-breed calf was admitted to the Large Animal Sector of the Veterinary Teaching Hospital at Paranaense University (UNIPAR) in Umuarama, Paraná, Brazil, presenting bilateral flexural deformity in the thoracic limbs. Clinical examination revealed non-reducible bilateral hyperflexion of the metacarpophalangeal joint, with dorsal weight-bearing sores. Radiographic examination confirmed metacarpophalangeal hyperflexion with no underlying bone abnormalities, leading to a diagnosis of flexural deformity. The initial therapeutic approach involved tenotomy of the superficial and deep digital flexor tendons. Additionally, the interosseous muscle tendon, distal ligaments of the accessory digits (II and V), flexor tendons of digits III and IV, and the flexor manica were transected. Metacarpophalangeal arthrotomy was also performed. Robert Jones bandages were applied to both limbs to protect and support the joints, preventing cranial displacement and metacarpophalangeal flexion immediately after cast removal. After seven days, the immobilization and sutures were removed, with significant improvement in the metacarpophalangeal joint angle.

***Discussion*:** Flexural deformity is a common orthopedic condition in cattle and horses, particularly in young animals, characterized by the inability to fully extend limb joints due to shortening or contraction of flexor tendons, suspensory apparatus, ligaments, or joint capsules. The etiology is variable, including prenatal and postnatal factors, genetic predisposition, intrauterine conditions (e.g., space restriction), and nutritional imbalances. In severe cases, surgical treatment is recommended, and the removal of all anatomical restrictions is crucial. If tenotomy alone does not restore full extension, arthrotomy may be necessary. In this case, arthrotomy combined with synthetic cast immobilization and a Robert Jones bandage ensured limb extension, contributing to a positive outcome. Despite its invasiveness, this technique should be considered even in early-stage cases, as chronicity may lead to irreversible dorsal limb lesions due to abnormal weight-bearing, which can compromise the skin, tendons, joint capsule, and articulation. Novel surgical approaches are crucial for challenging cases where conventional methods fail. Here, arthrotomy with distal limb immobilization effectively resolved severe congenital flexural deformity, ensuring full recovery. The success of this case suggests early surgical intervention with anatomical release may prevent degenerative changes and improve long-term outcomes.

Keywords: arthrotomy, tenotomy, locomotion, cattle, SDFT, DDFT, tendons.

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INTRODUCTION

Flexural deformity is a common condition resulting from contracture of the superficial digital flexor tendon (SDFT) and/or deep digital flexor tendon (DDFT) [3], which can affect the carpal, metacarpophalangeal, and distal interphalangeal joints, significantly impairing locomotion and normal development in affected calves [6]. Although the exact etiology remains unclear, genetic factors such as autosomal recessive genes and environmental influences, including exposure to toxic plants, infectious diseases, nutritional imbalances during pregnancy, or abnormal intrauterine positioning are considered contributing factors [6,7]. Diagnosis is achieved through clinical palpation of affected tendons and radiographic examination to confirm clinical suspicion [3]. According to Chakraborty *et al.* [2], contractures can be classified into 3 categories: mild cases that resolve spontaneously, moderate cases requiring clinical or surgical correction, and severe cases that rarely resolve even with surgical intervention. Early diagnosis of mild to moderate cases leads to better outcomes with clinical treatment and physical therapy [6]. However, severe deformities often require partial or complete tenotomy procedures, though some severely affected calves may not respond to treatment and euthanasia may be necessary [6]. This article reports the surgical treatment of bilateral metacarpophalangeal flexural deformity in a calf.

CASE

A 9-day-old male mixed-breed calf was admitted to the Large Animal Unit of the Veterinary Teaching Hospital at Paranaense University (UNIPAR) in Umuarama, Paraná, presenting bilateral flexural deformity in the thoracic limbs. Clinical examination revealed normal physiological parameters and the ability to maintain quadrupedal stance. However, limb inspection showed bilateral non-reducible hyperflexion of the metacarpophalangeal joints with dorsal weight-bearing sores (Figure 1 A, B & C). Radiographic examination confirmed metacarpophalangeal hyperflexion without evidence of bone abnormalities (Figure 1D), leading to a diagnosis of flexural deformity.

Figure 1. A, B & C- Nine-day-old calf presenting with bilateral flexural deformity of the metacarpophalangeal joint. D- Latero-medial radiographic image of the right thoracic limb.

Figure 2. A- Immediate postoperative period with extension of the right thoracic limb. B- Calf in standing position with bilateral immobilization using synthetic cast. C- Robert Jones bandage combined with a splint after removal of the synthetic cast. D- Thoracic limbs showing proper positioning prior to hospital discharge..

The therapeutic approach involved surgical intervention. Initial treatment consisted of tenotomy of the superficial and deep digital flexor tendons. Following a 4-h fast, the calf was sedated intramuscularly with 2% xylazine[1] [Calmium® - 0.05 mg/kg] and midazolam[2] [Dormire® - 0.1 mg/kg], and local anesthesia was achieved using 2% lidocaine[3] [Lidocol® - 7 mg/kg] through regional infiltration. Routine asepsis was performed with 2% chlorhexidine scrub and 70% alcohol.

A 4 cm incision was made on the lateral aspect of the left metacarpus at its mid-third, where the superficial and deep digital flexor tendons, along with the interosseous muscle tendon, were identified and transected. Skin closure was performed using a simple continuous pattern with size zero nylon suture. Immediate post-procedure assessment revealed persistent metacarpophalangeal joint hyperflexion, necessitating metacarpophalangeal arthrotomy. Following additional anesthetic blockade and surgical preparation as previously described, a 4 cm lateral incision was made.

The distal ligaments of accessory digits V and II were transected, along with the deep and superficial flexor tendons of digits III and IV, and the flexor manica. Subsequently, the metacarpophalangeal joint capsule was incised, achieving full limb extension (Figure 2A). Following cutaneous closure with size 0 nylon in a simple continuous pattern, a Robert Jones bandage was applied, followed by a synthetic cast to maintain the limb in extension (Figure 2B).

The contralateral limb underwent an identical surgical procedure 72 h later, also requiring arthrotomy and synthetic cast immobilization. Postoperative care included flunixin meglumine[3] [Flumax® - 1.1 mg/kg SID for 3 days] and enrofloxacin[3] [Enro10® - 10 mg/kg SID for 5 days]. The calf was stall-confined with controlled exercise (20 min twice daily). After 7 days, the

cast and sutures were removed, revealing a significant improvement in the metacarpophalangeal joint angle.

The right thoracic limb developed pain and increased joint temperature postoperatively, prompting regional perfusion with gentamicin[4] [Gentatec® - 200 mg twice at 48-h intervals] and additional intramuscular therapy with ceftiofur[3] [Cetofur® - 2.2 mg/kg SID for 5 days]. Robert Jones bandages were maintained on both limbs during this period to provide joint protection and support, preventing cranial displacement and metacarpophalangeal joint flexion during initial post-cast removal (Figure 2C). Following this treatment, the calf achieved complete recovery with normal ambulation (Figure 2D).

DISCUSSION

Flexural deformity is a common orthopedic condition in cattle and horses, particularly in young animals, characterized by the inability to fully extend limb joints due to shortening or contraction of the flexor tendons, suspensory apparatus, ligaments, or joint capsule [1]. In rare cases, the suspensory ligament of the fetlock may also be the limiting structure, as well as a constrictive element of the joint capsule [4].

The etiology of this condition is variable and may include prenatal and postnatal factors, as well as genetic predisposition, intrauterine conditions (such as space restriction and nutritional imbalances) [2]. Neuromuscular disorders, impaired elastin production, and defective collagen fiber adhesion have also been linked to its development [4]. Additionally, it may be associated with other congenital conditions, such as cleft palate, dwarfism, and arthrogryposis [6]. This contrasts with current studies in which no cases presented with concurrent congenital abnormalities. Research suggests that this condition is more common in males, as described in this report, indicating that - beyond environmental factors - there may be a genetic or sex-linked hormonal influence contributing to its development [2].

Metacarpophalangeal deformities can be classified as mild, moderate, or severe. Patients with mild deformities exhibit slow, unsteady gait, bearing weight on the toe but failing to support the caudal aspect during limb extension, though they can maintain a normal anatomical stance. In moderate cases, patients require assistance to stand and present an abnormal angle that cannot be corrected through passive extension of the foot or joint. Severe cases are characterized by weight-bearing on the dorsal surface of the fetlock, with complete misalignment of the fetlock or carpal joints [2], as observed in the present case.

Regarding diagnosis, early identification is crucial for determining the appropriate treatment. Clinical evaluation is essential and typically includes visual inspection of limb positioning and angulation, as well as palpation of tendons and joints [4]. Radiography helps differentiate between deformities caused by bony abnormalities; the absence of radiographic changes suggests that tendon shortening may be a limiting factor in normal limb extension [1].

Mild flexural deformities can be managed conservatively. Silva *et al.* [10] and Chakraborty *et al.* [2] reported that oxytetracycline administration, combined with PVC splints and pain control using anti-inflammatories, effectively promoted limb extension.

Few studies accurately describe surgical protocols for tendinopathies [7]. The most common surgical approaches involve tendon transection, depending on joint severity, including complete or partial "Z" tenotomy, which is applied when controlled tendon lengthening without complete transection is required [2, 7, 11].

In severe cases, Corrêa & Zoppa [4] and Anderson *et al.* [1] emphasize the importance of removing all anatomical restrictions. Joint capsule fibrosis may significantly restrict movement even after flexor tendon transection. If tenotomy fails to fully restore optimal extension, joint capsule release (arthrotomy) may be necessary [3,11]. This was observed in the present case, corroborating these authors. Despite initial tenotomy techniques being attempted, the 9-day-old calf lacking joint fibrosis required arthrotomy, followed by synthetic cast immobilization and a Robert Jones bandage, which maintained limb extension and was critical for a positive outcome. However, in the case reported by Compagnoni *et al.* [3], arthrotomy alone allowed adequate joint release and limb extension without additional immobilization, with only a wooden toe extension shoe and physical therapy sessions being used. This suggests that responses may vary between cases.

Postoperative complications can increase patient morbidity, exacerbate pain, and incur additional costs for the owner. Reported complications of orthopedic surgery include surgical site infections, osteomyelitis, septic arthritis, seroma, delayed wound healing [5], support limb laminitis [9], septic tenosynovitis [8], among others.

The arthrotomy technique described by Compagnoni *et al*. [3] and replicated in this study did not result in severe postoperative complications. In this case, only mild joint temperature elevation and pain were observed, likely secondary to periarticular biomechanical changes caused by limb extension. Regional antibiotic perfusions were administered due to initial suspicion of septic arthritis, but recovery was satisfactory.

The recovery period was relatively short, with the calf being discharged after 15 days. Although highly variable and influenced by multiple factors, this was still shorter than the 70 days reported [3]. This reinforces that arthrotomy for severe congenital flexural deformities should be performed early, as it not only improves resolution rates but also reduces hospitalization costs and clinical management requirements, further justifying the procedure.

The development of novel surgical approaches is essential for managing challenging cases where conventional techniques yield unsatisfactory outcomes. In this case, arthrotomy combined with distal thoracic limb immobilization proved effective in resolving severe congenital flexural deformity and enabled complete patient recovery. Although more invasive, this technique should be considered even in early-stage or newly diagnosed cases, as chronicity may lead to irreversible dorsal limb lesions secondary to abnormal weight-bearing. Such chronic damage can progressively compromise the skin, tendons, joint capsule, and articular surfaces. The successful outcome in this case suggests that early surgical intervention with comprehensive anatomical release may prevent the development of secondary degenerative changes and improve long-term prognosis. This approach warrants further investigation as a potential first-line treatment for severe flexural deformities in calves.

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