RESEARCH ARTICLE

F.U. Vet. J. Health Sci.
2021; 35 (3): 127 - 130
http://www.fusabil.org

A Survey on the Diagnosis, Prognosis and Treatment of Congenital Flexural Deformities in Calves *

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Congenital contracture of the flexor tendons (CCFT) are frequently encountered in calves, with both congenital and acquired forms described. It was reported that the diagnoses, and outcome of treatment of flexural deformity of the carpus in 45 calves up to 5 months of age. Information was obtained from the medical records of calves treated for CCFT and through follow-up contact with owners. At the time of examination, each case was graded based on the severity of the flexural deformity as grade I, II, or III, in order of ascending severity. In grade I and II, the calves (n=35) were treated with Polivinil klorür (PVC) bandage and oxytetracycline administration. In grade III, the calves (n=10) were treated surgically. Surgical treatment consisted of tenotomy of the ulnaris lateralis and flexor carpi ulnaris tendons. Follow-up was obtained at least 3 months after the treatment via telephone contact with owners and/or breeders. Conservative treatment with PVC bandage and oxytetracycline administration of grade I and II CCFT's had an excellent prognosis for restoration of a straight palmar carpal angle. In cases of grade III CCFT, the prognosis following surgery is guarded, especially in neonates. The results of this study will help veterinarians to make recommendations regarding the conservative and surgical treatment of CCFTs.

Key Words: *Flexor tendon contracture, calf, oxytetracycline, tenotomy*

Buzağılarda Konjenital Fleksural Deformitelerin Tanı, Prognoz ve Tedavisi Üzerine Bir Araştırma

Konjenital fleksural deformiteler buzağılarda sıkça rastlanır ve hastalığın konjenital ve edinsel tipleri vardır. Bu çalışmada, kongenital fleksor tendo kontraktürü bulunan toplam 5 aylığa kadar yaşlı 45 buzağıda teşhis ve sağaltım yöntemlerinin karşılaştırılması amaçlanmıştır. Buzağılar muayene esnasında artan derecede 1, 2 ya da üçüncü derece tendo kontraktürü olarak sınırlandırılmışlardır. Birinci ve 2. derece tendo kontraktürü saptanan buzağılar (n=35) sadece Polivinil klorür (PVC) bandaj ve oksiterasiklin uygulanarak tedavi edilirken 3.derece tendo kontraktürü bulunan buzağılar(10 buzağı) tenetomi sonrası PVC bandaj uygulanarak sağaltıldı. Tenotomi ise m. ulnaris lateralis and flexor carpi ulnaris tendolarına uygulandı. Üç ay sonra hasta sahipleri telefonla aranarak hastaların son durumları hakkında bilgi alındı. 1. ve 2. derece karpal fleksural deformiteli hayvanlara uygulanan PVC bandaj ve oksitetrasiklin uygulaması sonucu carpal palmar açıda düzleşme ve mükemmel bir iyileşme gözlendi. 3. derece karpal fleksural deformiteli hayvanlara uygulanan cerrahi tedavi soncunda ise prognoz şüpheli olarak kabul edilmiştir. Bu çalışmanın sonuçları, veteriner hekimlerin konjenital fleksural deformiteli buzağıların konservatif ve cerrahi tedavisi ile ilgili öngörüde bulunmasına yardımcı olacaktır.

Anahtar Kelimeler*: Fleksor tendon kontraktürü, buzağı, oksitetrasiklin, tenetomi*

Introduction

Congenital contracture of the flexor tendons (CCFT) is defined as congenital malformation characterized by curvature of the limbs, multiple articular rigidity and muscular dysplasia. Arthrogryposis with associated malformations may be hereditary or a phenocopy of the mutant gene(s) effect produced by unknown factors. Arthrogryposis may afflict one leg, the hind or front legs, or all four legs, and has been reported in many breeds of cattle (1). Homozygosity of a single recessive gene has been proposed as a cause of arthrogryposis in Hereford, Charolais, Jersey and German Black Pied calves. Arthrogryposis associated with cleft palate was found in several breeds of cattle (2, 3). The ingestion of *Lupinus sericus* and *Lupinus caudatus* between the 40th and 70th day of pregnancy cause arthrogryposis and other malformations in calves. The disease known as crooked calf disease is characterized by flexure of one or more legs and occasionally associated with palatoschisis, torticollis and scoliosis (4). Outbreaks of arthrogryposis and hydranencephaly in cattle in Australia have been associated with high antibody titres to Akabane virus and to Aino virus (5). There have been reported of miscarriages and stillbirths associated with congenital arthrogryposis affecting mainly sheep but also cattle and goats. Tests carried out on cases in Germany and the Netherlands have identified a novel virus that has tentatively been named Schmallenberg virus (6).

Bandage application such as splint, polyviniyl clorit (PVC) and fiberglass materials and tenotomy are commonly used for the treatment of this disorder (7). Oxytetracycline

Received : 18.02.2021
Accepted : 15.04.2021

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* This study was supported by the Adnan Menderes University Scientific Research Foundation (Project Number: VTF-18013).

(OTC), an antibiotic, has been used in foals successfully for the treatment of flexoral tendon contraction (8). It has been previously demonstrated the tenotomy of the ulnaris lateralis, flexor carpi ulnaris tendons and the palmar carpal fascia transections (9-11), however these treatments and their effects were not clearly explained. Therefore, in this retrospective study, the diagnosis, prognosis and treatment outcomes of CCFT in calves will be evaluated.

Material and Methods

Research and Publication Ethics: All experiments were approved by Adnan Menderes University Local Board of Ethics Committe for Animal Experiments (Number-64583101/2021/019).

Clinic records of 45 calves admitted to Adnan Menderes University Surgery Clinic for CCFT were received and analyzed. The calves with unilateral or bilateral CCFT underwent a conservative surgery via a unilateral or bilateral transection of the ulnaris lateralis tendon and flexor carpi ulnaris tendon was also studied in this research.

The affected limbs of the calves were divided into three consecutive classes in increasing severity depending on their initial classification of the flexural defect (Table 1).

The signalement, synchronized disease development and musculoskeletal conditions were obtained from medical records. The supplementary postoperative medical management and supportive treatment were documented.

Table 1. A clinical classification and grading system of forelimb involvement for cases of carpal flexural deformities

Grade	ability to stand up	ability to standing	foot contact with the ground	ability to stretch of the affected joint
I	calf can stand up without assistance	calf can stand more than one minute without buckle forward	on the sole or on the tips of their claws	the leg can be combined with moderate force stretched passively in full
II	calf can stand up without assistance	calf buckle forward in less than one minute	only briefly on the sole but especially on the dorsal surface of the fetlock joint	leg can be of moderate effort does not extend fully
III	calf can not stand up with assistance	calf can not stand	remains at most short term on the dorsal surface of the fetlock joint	leg with moderate force can not even stretch approximate

Conventional Treatment: In grade I and II calves were treated with PVC bandage and oxytetracycline administration. Oxytetracycline was administered at a dose of 1mL/10 kg intramusculary (IM) once a day for 5 days. PVC bandage was applied to calves for 14 days.

Surgical Procedure: In grade III calves were treated with tenotomie. Procaine penicillin was given pre-operatively and continued for 3 days (22 mg/kg IM twice daily). Flunixine meglumine was given to healthy, well-hydrated calves at the time of pre-medication for the anesthesia (1.1 mg/kg IV once).

Surgery was performed under general anesthesia that was initiated and maintained with an intravenous detomidine-ketamine-midazolam combination and the calves were placed in lateral lying position with the affected limb at the upmost level. The tendons of insertion of the ulnaris lateralis and the flexor carpi ulnaris were cut through a lateral skin incision 5 cm long, pinpointed at the surface of the distal radial physis.

The two tendons of insertion of the ulnaris lateralis were marked, isolated by a blunt incision, and transected about 2 cm above the auxiliary carpal bone. A particular attention was given to avoid the the cut of lateral palmar vein and nerve. In the presence of a main part of muscular tissue at the performed tenotomy site, only the peripheral tendinous tissue was transected.

The underlying tissues were completely closed in a simple continuous design using 2-0 polydioxanone (PDS, Ethicon). Then the skin was stitched with horizontal sutures using 2-0 polydioxanone (PDS, Ethicon).

Postoperative Care: If the degree of extension was more than 50% postoperatively, the affected limb was covered by a fully padded limb bandage, and the calf was placed in a stall for 2 weeks.

In the case of less than 50% improvement of that recorded initially, a plastic-cast was administered into the limb (Figure 1C). The limb was then re-evaluated after 24 hours for the improvement of the CCFT and the strap was put on daily if necessary for up to 5 days.

Follow-up: Change in the degree of carpal extension in the immediate post-surgical period was evaluated. If the flexural deformity had progressed less than 50% of that recorded initially, further strapping or casting was performed as explained in postoperative care above.

Further information was received at least 8 months after the operation by the phone with patient's owners and/or breeders.

Figure 1. (A) A grade II or moderate carpal flexural deformity with angular deformity in an 5-week-old calf **(B)** A grade III or severe carpal flexural deformity with angular deformity in an 6-day-old calf **(C)** A 20-days-old calf with PVC-cast after tenotomy of both forelimbs

Results

In this study, 45 calves were used. Twenty-seven of which, (60%) had bilateral forelimb involvement and eighteen calves (40%) had unilateral limb involvement. Thirty calves were male and fifteen were female. Breeds affected were Holstein-Fresian (30), Simental (10) and Brown Swiss (5). The median age on presentation was 16.5 days (range 1 to 90 days).

Twenty-one calves were grouped as grade I CCFT (21/45, 46.6%), 14 limbs were grouped as grade II CCFT (14/45, 31.2%) and 10 calves were grouped as grade III CCFT (10/45, 22.2%). Table 2 shows the calves demonstrated by the group classification of forelimbs, median age by the surgical operation, number lost to follow-up and successful results.

Table 2. Classification of forelimb involvement for cases of carpal flexural deformities included in this study

Severity of limbs affected	No. of calves	Median age (days)	No. lost to follow-up	No. of successful outcomes	% successful outcomes
Bilateral Grade I OTC+PVC	12	18	1	11	100
Bilateral Grade II OTC+PVC	9	17	1	8	100
Bilateral Grade III Tenotomy	6	13	0	2	33
Unilateral grade I OTC+PVC	9	21	1	7	100
Unilateral Grade II OTC+PVC	5	16	1	4	100
Unilateral Grade III Tenotomy	4	14	0	1	25

A positive outcome was demonstrated in 34 out of the 45 (75.5%) calves operated in total. Of 21 grade I calves, two calves got lost to the follow-up and a positive outcome was noted in the remaining cases. Of 14 grade II, two calves were lost to follow-up, no failures were pinpointed, the outcome was very successful (100%). Of 10 grade III calves, no calf was lost to follow-up, seven limbs did not show improvement and three calves demonstrated a successful outcome (31%).

Elf calves with CCFT were demonstrated at 14 days of age or less. Of the elf calves, six had grade III CCFT and five had grade II CCFT. The six calves with grade III CCFT did not stand and suckle without help. Six calves had simultaneous medical and/or extra orthopaedic problems such as peritonitis (1/6), pneumonia (2/6), infectious arthritis (2/6) and meta-carpo phalangeal flexural deformity (3/6). Of the elf calves presented at 14 days of age or less, five calves did not show any successful outcome (45%). All five calves that were considered a failure had repeating medical and/or additional musculoskeletal problems.

The majority of CCFT cases presented at greater than 14 days of age and up to 5 months of age. Five failures were recorded in this age group (18%). Three calves presented between 2 months of age and 5 months of age.

Of the ten grade 3 limbs, all (100%) required postoperative splinting or PVC casting after failure to achieve 50% improvement in extension following surgery.

It was reported that three cases had wound dehiscence or infection postoperatively. In two cases, a mild fibrous swelling-at the surgical site was reported at the time of long-term follow-up.

In addition to CCFT, 20 of the 45 (51%) calves presented with an angular limb defect (ALD). Of the 21 grade I calves, 7 calves had repeating ALD (33.3%). A carpal valgus defect was noted in 5 of the 7 calves (71.5%) and a fetlock valgus in 2 of the 7 calves (28.5%). Of the 14 grade II calves, 7 limbs had a repeating ALD (50%). A carpal valgus defect was noted in 4 of the 7 calves (57%) and a fetlock varus in 3 of the 7 calves (43%). Of the 10 grade II calves, 6 calves had a repeating ALD (60%). A carpal valgusdefect was noted in all six calves (100%).

Discussion

The percentage of positive outcomes for the treatment of the grade I and grade II CCFT calves was greater than for that of grade III cases. In addition to surgical care, 100% of the grade 3 cases required straps or casts to cure the flexural defect and only 29% of this group had a positive result. Our results are in accordance with previous reports, which demonstrates a poor prognosis to calves with moderate CCFT (12, 13)

Grade I and grade II CCFT cases were older than grade III CCFT cases. This was probably related to some subsequent medical and orthopaedic problems, and the failure in standing and suckling in the more severe cases requires earlier veterinary treatment. This finding is consistent with the previous investigation of Charman and Vasey (4) in foals.

Many techniques have been reported for the treatment of tendon contracture in calves and foals (1, 2, 4) Depending on surgical procedures and long term immobilization of the leg, various complications such as adhesion, muscle and tendon atrophy, decubital wounds

can be experienced postoperatively (14, 15). Such tendon and muscle disorders were not encountered for any of the calves in grade I since they were allowed to move without any restrictions. However, regional tendon and muscle atrophy were observed for the grade II calves, in wich PVC bandage were used.

Several authors believe that grade I and grade II CCFT are self-limiting and do not need any specific treatment if the the calf is ambulatory (2-4). In our study the median age (17 days) for the presence of CCFT indicates that this is not always the case. The traditional treatment of the calves from the beginning of the 6 weeks of age is unlikely to be permanently successful, because the tendons and palmar soft tissue structures have already been subjected to a permanent pressure from weight bearing and ambulation. Oxytetracycline has no direct effect on tendon function. It causes calcium absorption near the joint surface reducing the bone tension and therefore, short tendon is extended (4, 11).

Progress in the extension of the limb following the tenotomy procedure was prognostic of the improvement in the CCFT postoperatively (4, 13, 16). It was on the basis of less than 50% progress of extension post-operatively in which a decision was made to strap or cast the limb. A crucial part of the surgical treatment of CCFT is the postsurgical assessment of the improvement in the extension of the limb. This will allow a decision to apply straps or casts as well as will provide more correct advice to the owners for the prognosis of each case.

Many calves that presented for CCFT also had simultaneous ALD. In fact, many of these calves showed some non-specific limb defects, and on examination, were found to have a manifestation of CCFT together with ALD. In cases where carpal varus defect was present with CCFT, resolution of carpal varus was often succeeded with the correction of CCFT alone. The authors fixed the CCFT first in these cases, then re-examined the calf for the 2 to 4 weeks postoperatively to decide whether or not additional treatment was needed to fix the carpal varus deformity.

An excellent outcome for the treatment of grade I and grade II CCFT. However, the prognosis for the treatment of grade 3 CCFT using this surgical treatment was poor, especially if the affected calf was in the neonatal period. The ages of calves represented in this study also indicate that CCFT is not often a self-limiting problem. The results of this study will help the veterinarians to make recommendations and correct decisions regarding the conservative or surgical treatment of CCFT.

References

1. Ames NK. Tendon injuries. In: Howard JL (Editor). Current Veterinary Therapy: Food Animal Practice 3th Edition, Philadelphia: Saunders 1993; 880-896.
2. Anderson DE, Desrochers A, Jean GS. Management of tendon disorders in cattle. Vet Clin North Am Food Anim Pract 2008; 24: 551-566.
3. Anderson DE, Jean GS, Morin DE. Traumatic flexor tendon injuries in 27 cattle. Vet Surg 1996; 25: 320-326.
4. Charman RE, Vasey RJ. Surgical treatment of carpal flexural deformity in 72 horses. Aust Vet J 2008; 86: 195-199.
5. Coverdale OR. Congenital abnormalities in calves associated with Akabane virus and Aino virus. Aust Vet J 1978; 54: 151-152.
6. Gibbens N. Schmallenberg virus: A novel viral disease in northern Europe. Vet Rec 2012; 170: 58.
7. Ducharme NG. Flexural deformities. In: Fubini FS, Ducharme NG. (Editors). Farm Animal Surgery 1st Edition, Philadelphia: Saunders 2004: 486-489.
8. Madison JB, Garber JL, Rice B, et al. Effect of oxytetracycline on metacarpophalangeal and distal interphalangeal joint angles in newborn foals. JAVMA, 1994; 204: 246-249.
9. Johnson JH. Contracted tendons. Modern Veterinary Practice 1973; 54: 67-69.
10. Kılıç N, Köklü S. Surgical treatment of congenital arthrogryposis in 38 calves. Cattle Pract 2012; 20: 88-92.
11. Cihan M, Atalan G, Özba B, et al. Treatment of the congenital fleksural tendon contractures by oxytetracycline administration in calves. Ind Vet J 2004; 81: 316-318.
12. Laven RA, Cook N. Correction of tendon contracture in calves. Vet Rec 1997; 22: 587.
13. Leipold HW, Hiraga T, Dennis SM. Congenital defects of the bovine musculoskeletal system and joints. Vet Clin North Am Food Anim Pract 1993; 9: 93-104.
14. Metzner M, Maierl J, Absmaier AG, et al. Congenital contracture of flexor tendons in calf. Tieraertzl Praxis 2007; 35: 247-254.
15. Verschooten F, DeMoor A, Desmet P, et al. Surgical treatment of congenital arthrogryposis of the carpal joint associated with contraction of the flexor tendons in calves. Vet Rec 1969; 85: 140-171.
16. Wehrend A, Jung C, Bostedt H. Zur Behandlung der kongenitalen Fesselbeugehaltung beim Kalb. Tieraertzl Praxis 2003; 31: 254-259.