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Calf Metacarpal Fractures in Association with Bovine Dystocia: Case Series Among Calves

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Absract: Metacarpal fractures related to excessive and/or inaccurately traction during delivery has been encountered in large animal livestock. The purpose of this study is presented of clinical features of metacarpal fractures in calves by regarding different applications and bone's biophysical risk factors. Medical records of metacarpal fractured calves between January 2006 and January 2013 were evaluated. After clinical and radiographically examinations, the types and localization of fractures were recorded. Regarding to the individual condition of calves and also attitude of owner, several treatment procedures were performed. Thirty-two metacarpal fractures in Holstein-Friesian calves related to extraction force were studied. All fractures were observed around that the place of the rope application. Most of the fractures [22 of 32 cases (68.75%)] were located distal 1/3 part (distal 33.3%) of the bone. Total 19 oblique, 10 transversal, 3 transversal comminuted fractures were determined. Soft tissue lesions (edema, subcutaneous and/or petechial hemorrhage) on the skin recorded concomitantly. By improving the design of fetal extraction tools and alternative applications for extraction, incidence of this complication may be reduced in the future.

Keywords: Assisting calving, Calf, Dystocia, Metacarpal fracture.

Sığırlarda Güç Doğum ile İlişkili Buzağı Metakarpal Kırıkları: Buzağılar Arasından Olgu Serisi

Öz: Büyükbaş hayvancılık işletmelerinde, doğum sırasında aşırı çekme ve/veya yanlış uygulamalar sonucunda matakarpal kırıklara rastlanmaktadır. Bu çalışmanın amacı, farklı uygulamalara ve kemiğin biyofiziksel risk faktörlerine göre buzağılarda metakarpal kırıkların klinik özelliklerinin sunulmasıdır. Ocak 2006 ile Ocak 2013 arasında metacarpus kırığı olan buzağıların medikal kayıtları değerlendirildi. Klinik ve radyografik muayeneler sonrasında kırıkların tipleri ve lokalizasyonu kayıt altına alındı. Buzağıların bireysel koşulları ve sahibinin tutumu ile ilişkili olarak tedavi prosedürleri uygulandı. Güç doğum sonucu 32 adet Holstein-Friesian ırkı buzağıda oluşan metacarpal kırık incelendi. Tüm kırıklar halatın uygulandığı bölgenin etrafında görüldü. Kırıkların büyük bir bölümü [32 vakanın 22'si (%68.75)] kemiğin distal 1/3'ünde (distal %33.3) gözlendi. Toplamda 19 oblik, 10 transversal, 3 transversal parçalı kırık tespit edildi. Aynı zamanda deride yumuşak doku lezyonları (ödem, subkutaneöz ve/veya peteşiyal hemorajier) kayıt altına alındı. Fetal ekstraksiyon araçlarının tasarımını ve ekstraksiyon için alternatif uygulamaları geliştirerek, gelecekte bu komplikasyonun insidansı azaltılabilir.

Anahtar Kelimeler: Buzağı, Doğuma yardım, Güç doğum, Metakarpal kırık.

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INTRODUCTION

Extremity fractures are common than other fractures (skull, spine, pelvis, sacrum etc.) in cattle (1-3) and various treatment techniques have been described (4-7). Metacarpus and metatarsus are the most fractured bones of the calves, generally occurred during dystocia (1). Dystocia may occur if there is failure in one or more of the three main components of calving; expulsive forces, birth canal adequacy and fetal size and position. Risk factors of dystocia have been categorized as maternal factors (breed, age, parity, body weight and pelvic size), fetal factors (birth weight, sex, presentation, position, posture and anomalies etc.) gestation length and sire effects. Bovine dystocia cases are associated with high economic losses in dairy farms (8). In order of descending financial importance, dystocia in confinement systems impacts production (41% of costs) and calf morbidity and mortality (25%), excluding costs associated with increased culling, veterinary costs and other management costs (9).

Inaccurately applications in dystocia have an effect on the vigour of the calf (10,11). Several researchers have been reported that inaccurately or excessive tractions during assisting calving are resulted with traumatic disorders in muscles, bones, joints, nerves and other soft tissues firstly on metacarpus and metatarsus (12-14). Metacarpal fracture is the most encountered fractures followed by metatarsal, femoral, radial and tibial fractures, respectively (13,15).

To decrease the fetal orthopedic complications and also economic losses related to bovine dystocia, retrospective evaluation of clinical cases should be considered. The aim of this study was to present the type, localization and clinical findings of metacarpal fractures that encountered in newborn calves during dystocia.

MATERIALS and METHODS

The materials of this study were selected from patients referred as metacarpal fracture to Department of Surgery, Faculty of Veterinary Medicine, Adnan Menderes University, Aydın-Turkey, between 2006 and 2013. Totally 53 metacarpal fractures were found between 2006 and 2013, and 32 cases of these patients were undergone excessive and/or inaccurately extraction in delivery. All of these 32 calves (11 female/21 male) were Holstein-Fresian and between 1-60 days old (13.56±19.87). They were clinically examined and recorded as exposed to the extraction force with rope on metacarpus during delivery. Fractures were recorded as on the 13 right forelimbs and 19 left forelimbs. Twelve calves from the study materials, aged between 8-60 days (33.91±19.73), were treated inappropriately, and ensued pseudoarthrose. Reminder 20 calves of the study materials were referred directly to our clinic.

Following clinic and radiographic examination, the configurations of fractures were detected. The localizations of fractures were also calculated as: “distal fragment length/total metacarpus length” on radiographs. Three treatment procedures (PVC bandage, plate osteosynthesis and external fixation) were performed according to type of fracture, health and housing conditions of animals.

The study is conducted in accordance with ethical principles of animal experiments.

RESULTS

Age, gender, weight, limb, localization configurations of fractures are presented in Table 1. All fractures were located on the distal bone (minimum, distal 14.3%; maximum, 41.2%; mean, distal 29.01%), and 22 of 32 fractures (68.75%) were located distal 1/3 part (distal 33.3%) of the bone (Table 1), where the first loop place of the rope (Figure 1).

Total 19 oblique, 10 transversal, 3 transversal comminuted fractures were determined. Intense swelling and bruises on the surrounding soft tissues

were confirmed. After shaving, soft tissue lesions (edema, subcutaneous and/or petechial hemorrhage) also demonstrated concomitantly (Figure 1a,b). Moreover, squeezed area around the fracture location caused by applied rope, impress area (Figure 1a,b), and slightly hypothermic lower limbs were recognizable during palpation. Wrong or empirical bandage applications, ensued pseudoarthrosis, were detected in oldest 12 calves (Figure 2a). One of the cases is referred with open fracture and infection (case 32); external fixation had proposed; but owner did not bring the calf on the surgery day (Figure 2b). PVC bandage (18/32), plate osteosynthesis (11/32) and external fixation (2/32) were preferred as a treatment of the cases. Calves were monitored during next 60 days in different intervals. In post treatment controls, it was observed that 31 metacarpus fractures were recovered successfully.

Table 1: Characteristics of calves and fractures.
Tablo 1: Buzağılar ve kırıklara ait özellikler.

Case no	Gender	Age (day)	Weight (kg)	Side	Localization and configuration of fractures
1	M	1	36	L	Distal 36.1% oblique, closed
2	M	60	42	L	Distal 20.7% transversal, closed
3	M	1	38	R	Distal 17.9% oblique, closed
4	M	1	45	L	Distal 14.3% oblique, closed
5	M	2	47	R	Distal 14.3% oblique, closed
6	M	1	39	R	Distal 30.0% transversal, closed
7	M	2	45	L	Distal 33.3% transversal comminuted, closed
8	M	8	45	L	Distal 36.6% oblique, closed
9	F	1	38	L	Distal 19.4% transversal, closed
10	M	45	42	L	Distal 33.3% oblique, closed
11	M	1.5	45	L	Distal 33.3% transversal, closed
12	M	2	45	L	Distal 34.1% transversal, closed
13	M	1	40	L	Distal 35.3% transversal, closed
14	M	17	45	L	Distal 35.5% oblique, closed
15	F	1	40	R	Distal 31.4% oblique, closed
16	M	2	47	L	Distal 33.5% oblique, closed
17	M	11	35	R	Distal 37.8% oblique, closed
18	F	1	35	L	Distal 27.2% oblique, closed
19	M	60	38	R	Distal 24.5% transversal, closed
20	M	1	40	R	Distal 31.5% oblique, closed
21	F	1	35	R	Distal 30.0% oblique, closed
22	M	1	38	R	Distal 29.8% oblique, closed
23	F	34	40	R	Distal 25.8% oblique, closed
24	F	1	38	R	Distal 28.4% transversal, closed
25	F	60	34	L	Distal 15.5% oblique, closed
26	F	30	34	L	Distal 34.1% oblique, closed
27	M	22	35	L	Distal 27.0% oblique, closed
28	M	1	47	L	Distal 41.2% transversal, closed
29	M	15	40	L	Distal 35.0% transversal comminuted, closed
30	F	3	40	R	Distal 16.1% oblique, closed
31	F	1	41	R	Distal 32.1% transversal, closed
32	F	45	34	L	Distal 33.3% transversal comminuted, open

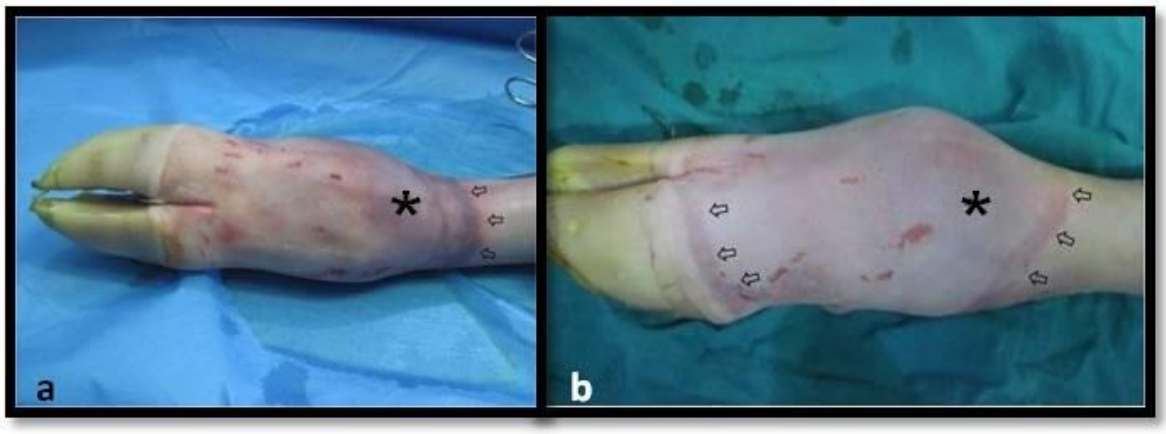

Figure 1: Impressed skin by the rope (arrows) on distal metacarpus (a, b) and above the hoof (b), swelling and hemorrhage (*) on the distal metacarpus (a, b).
Şekil 1: Distal metacarpus (a, b) bölgesinden ip ile çekilen ayağın derisindeki şişlik ve hemorajiler (*).

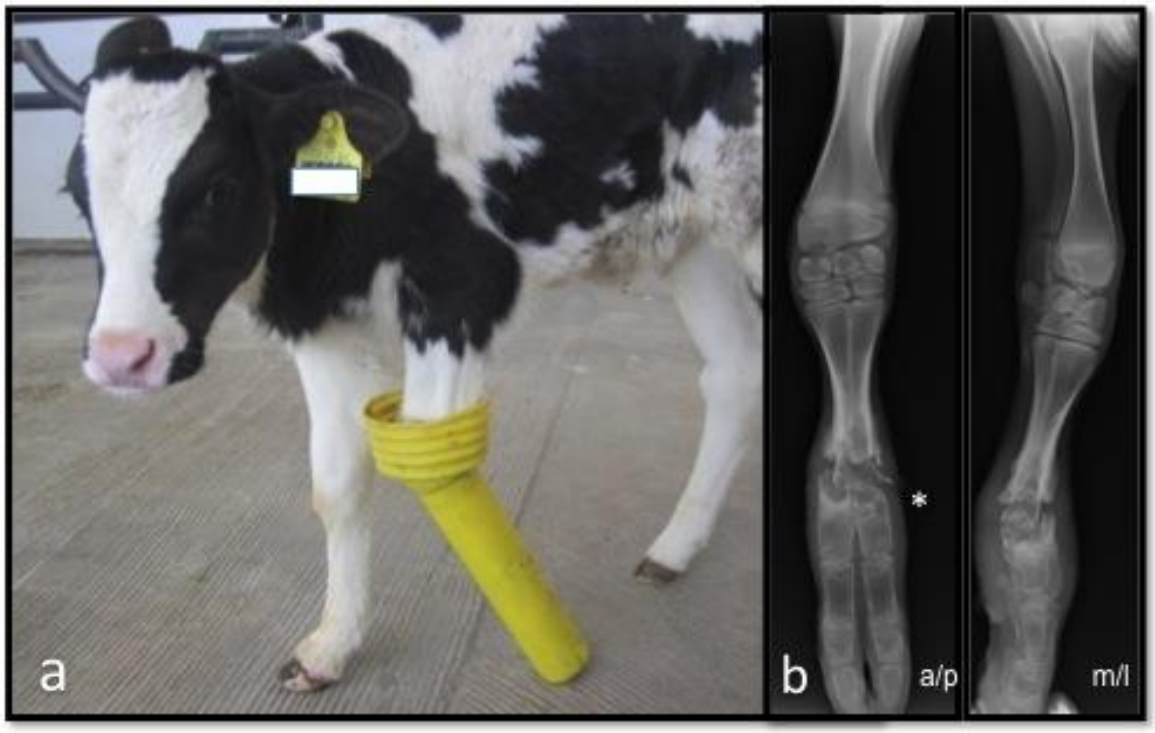

Figure 2: Empirical bandage applications on metacarpal fracture by owner (a), radiography (b) of transversal comminuted, open (*) metacarpal fracture.
Şekil 2: Hayvanın sahibi tarafından yapılan ampirik bandaj (a), röntgen görüntüsü (b) transversal parçalı açık (*) metacarpal kırık.

DISCUSSION and CONCLUSSION

The west region of Turkey has considerable dairy farms where Holstein-Friesian is the principal breed. Similarly, in this study all the calves were Holstein breed. According to our clinic records, total 53 metacarpal fractures were found between 2006 and 2013, and 60.37% of the patients were undergone excessive and/or inaccurate extraction during delivery.

Dystocia is a problem especially in first-calf heifers and cattle (8). It results many complications of calves and one of them is metacarpal fracture (11,13,14). Although birth complications with fractures are commonly encountered, limited researches are found in the literature. Seven of 27 cases (12), 108 of 181 cases (14), 21 of 31 cases (16) and 8 of 20 cases during dystocia (17) were reported metacarpal fractures in different regions of Turkey. Comparably, metacarpal fractures are the most encountered fractures during bovine dystocia (1,13).

Male calves, oversized calves and higher birth weight are in the high-risk group for the second phase of the parturition evidently (8). Similarly, 65.62% of calves was male in this study and they had higher body weight (mean, 41.62 kg) than females (mean, 37.18 kg). Based on the author's experience, breeders generally prefer female calves because of their advantages like breeding and milk yield. Due to possible relationship, female calf owners were prone to accept all offered treatment procedures, on the contrary male calf owners preferred cheaper options (PVC bandage). Additionally, probably to make a cheaper treatment, the oldest 12 calves (8 male, 4 female) had already been incorrectly bandaged. Therefore, in this study, being male calf was evaluated as a disadvantage.

The interval between the first and the last case in this study is relatively long. Therefore, some information could not have evaluated because of the missing/incomplete records (such as evaluation of lower extremity circulation, size and parity of the mother cow). The incidence of dystocia is higher in heifers than cows (8). Choosing lower birth weight bulls for to heifers' insemination may reduce the calf birth weight and dystocia, consequently the risk of metacarpal fractures. If the records of parity of mothers were completed in this study, accurate assessment might be of beneficial.

Chains, cotton, nylon ropes and mechanical calf pullers are commonly proposed for using in the extraction force (18). Metacarpal fractures occur when pulling the calf in anterior presentation. The loop located anywhere on the metacarpus habitually slides downwards to reach up to fetlock joint and allows better emplacement. Two loops, one above the fetlock joint and the other half-hitch below the fetlock joint (above the hoof) are suggested during extraction force. These two loops, placing directly on the skin, distributes pressure when pulling the calf, and reduce the possibility of fracture than a single loop. Comparing to rope, chain application has more advantages; such as, less prevention of the blood circulation, easy to clean, sanitize and also handle (18). All calves of this study were extracted with nylon ropes; however, full information about the properties of the ropes (thickness, texture, length and suitability for extraction force) could not be recorded. The pressure zone, subcutaneous hemorrhage, hypothermic distal limbs caused by rope application were seen clearly in some cases of the study (Figure 1). Soft tissues are responsible for the blood supply through fractured bones (19), disorders of local circulation have a negative effect on the healing of fracture. Pulling period and length of extraction time should also be considered in future researches, which have not been studied in this study. In these regards, choosing of chain can reduce the recovery time of fracture.

In a previous study (20) reported that, the thinnest cortical bone and weakest section of the metacarpus are at the distal part of the bone. All fractures examined in current study were located on distal part of the metacarpus (mean, distal 29.01%). This part of the bone (above the fetlock joint) is also the area, where the compact bone changes to spongious bone and the place for the first loop of the rope. Sevil and Ocal (20) also indicated that, lateral and medial sides of the metacarpal bone is thicker than other side and may be more resistant to trauma. Regarding to this data, it may be important to prevent metacarpal fractures via applying loops by rope or chain on the placing lateral or medial sides of the bone before the extraction force. In order to reduce the pressure and prevent metacarpal fractures, the enlarged and thickened rope or chain

may be used on the above loop area. Using enlarged and thickened rope may provide to the spread and distribute to the stress on the distal part of the bone. Combination with enlarged and thickened rope and chain may be developed by the researchers and/or practitioners. Calf fractures are still an important issue in cattle breeding. Therefore, metacarpal geometry and biomechanical properties of the calf metacarpus should be investigated in laboratory or field conditions for new traction materials, models and methods. This subject would be the goal of future research for both scientists and private sector, or their cooperation.

As a conclusion, calves with lower vigour, and highly-risked ones for complications during healing of fracture increase the economic losses in dairy farms. Reconsidering the clinical cases may help to provide preventive and early treatment applications. To avoid metacarpal fractures during dystocia, developing new instruments and suggestions to proper extraction force on metacarpus would be examined. Additionally, due to the mainly fractures caused by dystocia were occurred distal part of the metacarpus, biomechanical factors of the bone should be evaluated in new born claves.

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