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RESEARCH ARTICLE

A Retrospective Study of Fractures in Neonatal Calves: 181 Cases (2002-2012)

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A B S T R A C T

The purposes of this study were to evaluate, etiology, radiological findings, treatment management, and to look at advantages and disadvandages of intramedullary nailing results of fractures in calves. One hundered eigthy one calves with fractures were used in the study. Distribution of calves was 130 Holstein (71.8%), 29 Brown Swiss (16.0%), 18 Simmental (9.9%), and 4 Charolais (2.2%). Fracture treatment was depending on the clinical findings. Conservative fracture treatment (walking cast technique), operative treatment intramedulary nailing or plate fixation) and/or amputation of the extremity were performed. To estimate of the etiology appeared that fractures of 59 (31.5%) calves had obtained during birthing due to excessive forced and inaccurate aiding, other 122 fracture (67.4%) cases were caused after trauma and badly care. Fractures were mostly happened on the metacarpal bones (60.6%) followed by femur (14.9%), metatarsal bones (7.1%), tibia (8.8%), ulna and radius(6 %) and humerus (n=6, 3.2%), Success of fracture healing depend on timing and proper selection of treatment. This study shows that intramedullary pinning fixation give a satisfactory results of calves with fracture.

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INTRODUCTION

Extremity fractures are seen frequently in calves. They occur in calves during forced extraction from birth and falls on concrete, or trauma from other animals in adults (Aksoy *et al*., 2009; Nuss *et al*., 2011). Fractures of the *femur* (14%), *metacarpus* (50%), *metatarsus* (50%) (Bilgili *et al*., 2008; Nichols *et al*., 2010; Rodrigues *et al*., 2012), *radius-ulna* (7%) (Görgül *et al*., 2004) and rarely vertabrae (7%) are commonly seen in calves. Fractures of the metacarpus are twice as common as metatarsal fractures (Steiner *et al*., 1996). Fracture of *pelvic*, proximal *femur*, axial skeleton, *rib* and *mandible* are rarer than the others in calves (Rasekh *et al*., 2011; Hoerdemann *et al*., 2012).

Görgül *et al.* (2004) is design in different types and locations of 31 fractures, 25% fractures applied during force extraction of birth and 12.1% depending on the trauma Calves with fractures had a depending on the recession and loss of appetite. Calves did not move, walk or stand on their feet might not want to remain in a position that is most comfortable lying down and hence preferred. X-ray gives important information for diagnosis, healing and prognosis of critical data.It causes a variety of positions in particular taken from lateromedial and caudo-cranial positions (Ewoldt *et al.,* 2003).

Selection of the calves with fracture treatment has to take considerations of the animals's genetic potential, economic,localisation and type of fracture sites (Görgül *et al*., 2004). The calves would have apositive effect in the healing process for a long period of time by an rest due to orthopedic problems. Reduction and external coapitation can be stabilized for broken bone or internal fixation could be required, but also applies to external fixations (Fessler and Adams, 1996). In farm animals, the bandaging technique supported with some materials such as polyvinylchloride (PVC) and aluminum and the splinting such as Thomas Splint alone or combined with bandage have been frequently used as a treatment choice for external fixation of closed fractures (Auer *et al.*, 1993; Nuss *et al*., 2011). The internal fixation techniques applied by using techniques such as intramedullar nailing, cerclage wiring, screw, dynamic compression plate (DCP), interlocking pins (Bellon and Mulon, 2011) were recommended in fixation of the dislocated, fragmented and complicated fractures (Martens *et al*., 1998).

Transfixation pinning and internal fixation techniques usually require general anaesthesia, special equipment and expertise. However, problems such as osteomyelitis, non-union and angular deformity reduce the success rate of these treatments in comminuted, open and infected fractures.

In this study, 181 calves with fractures to evaluate etiology, radiological findings, treatment management, and to look at advantages and disadvantages of intermedullary nailing results of fractures in calves referred to clinic between 2002-2012.

MATERIALS AND METHODS

One hundred and eighty one calves with fractures which referred to Selcuk University, Faculty of Veterinary Medicine, Department of Surgery Clinics were used as a material. Distribution of calves were 130 Holstein (71.8%), 29 Brown Swiss (16.0%), 18 Simmental (9.9%), and 4 Charolais (2.2%). Sex distrubition of calves with fracture 74 female (40.8 %), 107 male (59.1%). Age of the calves with fracture are shown table 1.

Fracture treatment was depending to the clinical findings. History was taken from the owners, Clinical and radiological examinations were done for all animals. Fracture treatment was performed depending on the clinical findings. Such as conservative fracture treatment (walking cast technique), operative treatment (intramedulary nailing and plate fixation) and/or amputation of the extremity were performed and healing results were followed in post-operative term by calling the owner. The stuructured questionnaire was used for surgical treated cases. Fracture types were rewieved and classified by radiographically. The surgical technique was based on evaluation of radiographs and the surgeon's preference.

Intramedullary nailing of metacarpal and metatarsal bones: Calves were held off feed for at least 24 hours to minimize regurgitation and decrease the likehood of aspiration pneumonia. General anaesthesia was induced with xylazine hydrochloride (Rompun, 2%, Bayer, 0,02 mg/kg, IM) and ketamine hydrochlorure (Ketasol 10%/ Interhas, 2 mg/kg IV) and maintained by administration via bolus of ketamine. The calves were placed in lateral recumbency with the affected limbs uppermost. The leg was clipped and aseptically prepared for surgery. A curvilinear incision through the skin and subcutaneous tissues was made from the carpometacarpal joint to the metacarpo/metatarsophalangeal joint. The apex of the curvilinear incision should be directed dorsally, and the plane of dissection is between the lateral digital extensor tendon and the common or long digital extensor tendon. Metacarpal or metatarsal bones were exposure simultaneously. One steinmann nails (trocar or threaded trocar) was placed to the medial intramedullary by retrograde technique. The proximal bone fragment was firmly held with bone forceps to prevent rotation the pin was advanced. The pin was started from the fracture site and advanced proximally up the marrow cavity through the cortex and out of skin. The pin chuck was then removed and placed on the proximal end of the pin, and the pin retracted until the distal point was level with the fracture site. The bone was anatomically reduced with the aid of bone forceps and held in reduction the pin into the distal fracture segment. If the fracture was oblique, the fragments are reduced and alignment was maintained with cerclage wires. The extremities were bandages with walking cast technique. The bandages were checked within two days.

Bone plate and screws: One bone plate being placed *metacarpal* bones dorsally for two cases. Surgical approach was done like intramedullary nail. Metacarpal bones were exposure simultaneously. The broad Dynamic Compression Plate (DCP) plate was placed on the side where the bony cortex was least likely to be anatomically constructed. Cortical screws were used.

Amputation: Four cases were amputated for forequarter amputation.The operation was started by make a skin incision from the dorsal border of the scapula, over the scapula spine to the proximal third of the humerus. Continue the skin incision around the forelimb at this level. The rhomboideus muscle from its attachment on the dorsal border of the scapula was transected and the serratus ventralis muscle from the medial surface of the scapula was elevated.

Postoperative treatment: Plaster bandages were performed to operate extremities after intramedullary nailing and bone plating operations. The cast was extended the joint above and the joint below the fracture site to reduce distracting forces. Antibiotics and analgesics were administered for five days. The calves were stayed in the hospital for five days. The post-treatment period was followed by calling the owners.

Descriptive statistics: Distribution of calves with fracture, sex, age distrubition, fracture localisation of the involved bones, and results of treatment was given by percentage.

RESULTS

The majority of fractures occurred during birth and some of them were learned after few days. To estimate of the etiology appeared that fractures of 59 (32.5%) calves had obtained during birthing due to excessive forced and inaccurate aiding, other 122 fracture (67.4%) cases were caused after trauma and badly care. Fractures and dislocations were more common when mechanical traction was applied because the force. Fractures were mostly happened on the metacarpal bones (60.6%) followed by femur (14.9%), metatarsal bones (7.1%), tibia (8.8%), antebrachium ulna and radius (6%) and humerus (3.2%) (Table 2). Localisation of the fracture line was distal diaphysis (84.5%), proximal diaphysis (10.4%), epiphysis (2.2%), metaphysis (1.6 %) and multiple fractures (1.1%) (Table 3).

One hundred thirty four patients were treated with closed reduction and full limb bandaged with plaster and polyvinychloride (PVC) materials (74.0%). Twenty two calves with fracture were operated.Twenty calves were operated with intramedullary nailing (11.0%), two animals Dynamic Compression Plate (DCP) platting

Table 1: Age-wise distribution of fracture in calves

Days	Number of Calves	Percentage
1-10	129	71.2
11-20	13	7.1
21-30	19	10.4
31-90	9	4.9
91-150	11	6.0

Table 2: Involvement of fore and hind leg of calves in fractures

Bone	Number (181)	Percentage	Open Fracture
Metacarpal bone	108	60.6	17
Femur	27	14.9	-
Tibia	16	8.8	1
Radius/Ulna	11	6	-
Humerus	6	3.3	-
Metatarsal bone	13	7.1	-

Table 3: Localisation of factures involving various

Bones	Number (181)	Percentage
Proximal diaphyseal	19	10.4
Distal diaphyseal	153	84.5
Metaphysis	3	1.6
Ephyseal	4	2.2
Multiple/Comminuted Fractures	2	1.1

Table 4: One hundred thirty four calves were treated by full cast and plaster. Twenty calves were treated intramedullary pinning. Two animals were treated screw and plate application. Four of them were amputated. Twenty one calves were not treated because of no client request.

	Number (181)	Percentage
Conservatif Treatment (Full Cast & Plaster)	134	74.0
Intramedullary pinning	20	11.0
Screw and plate application	2	1.1
Amputation	4	2.2
No. request for treatment	21	11.6

(1.1%) and four animals amputated because of steomyelitis (2.2%). Twenty one clients (11.6%) did not accept to treatment (Table 4). Postoperative radiographs were taken and there were not seen any complication.

DISCUSSION

In the study, 181 calves with fracture were seen period of 10 years. Fractures and dislocations were more common when mechanical traction was applied because the force. Traction was most commonly applied after the fetus has entered the birth canal and has not progressed for some time. Often there was manipulation of the fetus before resorting to forced extraction, resulting in the loss of lubrication to the birth canal and contraction of the myometrium around the fetus. Client education and careful procedural decision making by the veterinarian could be reduce dystocia-related injuries and perinatal deaths in calves (Aksoy *et al*., 2009; Nuss *et al*., 2011). In this study, to estimate of the etiology appeared that fractures of 59 (31.7%) calves had obtained during birthing due to excessive forced and inaccurate aiding, other 129 fracture (69.3%) cases were caused after trauma and badly care. Görgül *et al.* (2004) has also reported that the incidence of the disorders of extremites 80.6% was caused by inappropriate manipulations during helping for birth in calves. The fracture was occured within 1-10 days of birth, in general. Because of traumatic conditions. Neonatal bones have a low bone density and thin bony cortices (Fessler and Adams, 1996). Therefore, care of calves was very crucial after birthing.

Intramedullary devices have several advantages in fracture treatment, including restoration of bony alignment and early recovery of weight-bearing in calf, light weight animals (Adams and Fessler, 1996). These devices were intended to stabilize a fracture by acting as an internal splint, thus forming a composite structure of bone and rod in which both contribute to fracture stability (St Jean *et al*., 1992; Rodrigues *et al*., 2012). In this study, we have used intramedullary nails of 20 calves with long bone fractures. And not seen postoperative complication about healing fracture. Almost all cases were good condition in postoperatif term by clinically and radiological examination.

In the study, plating provides a rigid form of internal fixation used in the two calves with fracture. Neither intramedullar nail nor plate was offered to client, but, nailing has been selected because of expenses of plate and screws. However, bone plates in fracture fixation were very important. These include bone properties, plate material, screw- bone interface, number of screws, plate bone interface, placement of the plate relative to loading, and compression between fragments (Auer *et al*., 1993; Fubini and Ducharme, 2004). There were not seen any complications in the calves in post operative term. Eventhough, bone plating could be more succesful for approach and healing term. It is quite difficult to compare between nailing and bone plate because of more cases were needed. Thus, plate fixation at the distal metaphysis was thought to be more suitable than fixation using an intramedullary pin (Hoerdemann *et al*., 2012).

Almost 122 (65.6%) *metatarsal* and *metacarpal* fractures are amenable to external coaptation using a fiberglas full limb cast. The prognosis for long-term, pain free survival is excellent for closed fractures and fair for open fractures managed in this manner. Open fractures (18 cases) can sometimes be resolved with full casting, but the prognosis for a successful outcome diminishes substantially in comparison to be closed fracture and the expense of fracture management is significantly higher (Gangl *et al*., 2006). In the study, four cases were amputated because of osteomyelitis. Owners must be strongly advised of the difficulties and expense of treating open fractures. Totaly, 134 calves have been treated by the bandaging technique supported with some materials such as PVC, plaster and the splinting such as Thomas Splint alone bacause of the owners' economic situations.

It must be kept in mind that the fracture healing is affected by several factors such as an animal's age and overall health, the location and type of fracture, the severity of soft tissue injury, the presence of bacterial contamination, and the degree of motion at the fractures site (Aithal *et al.*, 2004; Gangl *et al*., 2006). In this study, four extremites were amputed because of bacterial contamination (osteomyelitis). Open fractures with severely traumatized soft tissues often become infected, which significantly complicates the repair. Infection and instability were intolerable together. If contamination of the fracture site occurs and persistent infection develops, instability and failure of the repair are highly probable. Preoperative antibiotics are always recomended before fracture repair with internal fixation (Fubini and Ducharme, 2004).

A successful outcome for internal fixation repair is inversely related to age, weight and size. The fracture must be evaluated to give an accurate prognosis. The more highly comminuted fractures generally, have a less favorable prognosis (Aithal *et al.,* 2010). In the study, if the calf with simple fractures were good candidates for internal fixation; because of periosteal bone and their more passive demeanor protecting the repair. Transverse fractures were more amenable to repair than comminuted fractures. On the other hand, the condition of the surrounding soft tissues should be considered in evaluation of a fracture. The surrounding soft tissues are responsible for extramural blood supply to the fracture site (Nuss *et al*., 2011).

Internal fixation's major advantages are that it provides rigid stabilization of the fracture and immediate, functional use of the limb (St Jean *et al*., 1992). It should be emphasized that ruminant orthopedic patients are generally weight-bearing and ampulatory early. Intramedullary pins could be contraindicated for the repair of long oblique, spiral or comminuted fracture without the use of devices that increase the primary repair and prevent overriding or rotation of the fracture fragments. The treatment of calves with fracture should be considered as a valuable profit to tolerate the economical waste in the calves having a value of high genetics.

Conclusion: Clinicians dealing with younger animals must be careful not to forget the rest of the body while concentrating on the fracture. The immunological status of newborn calves has to ases before attempting any form of surgical intervention. Success of fracture healing depends on timing and proper selection of treatment. This study shows that intramedullary pinning fixation give a satisfactory results of calves with fracture. Furthermore, under the light of results of this study, it is necessary that the informing and education of farmers regularly and continuously by field veterinarians.

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