

THE TREATMENT OF THE FOREARM FRACTURES IN DOGS

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Abstract

The practical implementation of this study was enabled by taking into consideration all the traumatized cases accompanied by fractures, presented at the Clinic of the Faculty of Veterinary Medicine during the period of March 2006 - March 2010. Special help for the implementation of this study was even offered by some private clinics in Tirana, from which we took a considerable number of valuable data. The cases of traumatized dogs were numerous and in different situations. Thus from this high number of the traumatizations accompanied by different fractures (altogether 115 dogs), 34 of them had fractures in the forearms bones. All these cases underwent surgical treatment through osteosynthesis with blood and external immobilization. We also treated cases of complications in healing these fractures after surgical treatment. The complications in the recovery of the fractures of the long bones in dogs are frequent. Above all they are first noticed in the bones of the forearm. Different problems might be identified such as mal joints, lack of joints, retarded joints and osteomyelitis. These because of the limited covering of the focus of the fracture by the soft tissues, lack of blood supply of the region as well as of the characteristic anatomo-topographic structure that this region has. Specifically the data that were taken into consideration included the period of recovery, the characteristics of the fracture, the type of surgical treatment and the final result. The fractures are often presented as closed fractures and less as transverse and oblique fractures. The most frequent treatment is the conservative one through external immobilization and in some cases of fractures of the radius the treatment was performed with endomedullar rods.

Key words: forearm, fracture, osteosynthesis, dog.

1. Introduction

The aim of this study is the evaluation of the results taken from treatment with different techniques of the osteosynthesis of the fractures of bones of the forearm. 34 dogs with forearm fractures were examined while they were treated at the Clinic of the Faculty of Veterinary Medicine during March 2006-March 2010 with the diagnosis of bone fracture of the forearm and complications of their surgical treatment. Forearm fractures occur frequently among dogs. They represent from 8.5 % -18% of the damages of limbs in dogs [16]. The healing of these fractures might be problematic, while complications are relatively high because of the limited cover of the region surrounded by soft tissues, poor blood supply and specific anatomo-topographic structure. [16]. The most frequent complications noticed in this delicate osseous region are: retarded joints, lack of joints, mal joints, growth disorders, osteomyelitis and articular rigidity. [9]. The retarded joints, lack of joints and mal

joints are considered as pathologies of healing or disorders of the normal process of bone repair. [12]. The responsible factors of lack of fractures healing are an attribute to the place of fracture, multiple fractures in the same limb [6, 12]. For these reasons the disorders of fracture consolidation result more exposed, metaphyseal fractures compared to diaphyseal ones because of poorer vascularisation, fractures in the level of the forearm because of little cover with soft tissues compared to those that have small contact surfaces among fragments. [12]. Retardation in fracture healing and pseudoarthrosis are presented in two important different phases of the pathological trauma [14] known by the same causes [5, 12] which are: fractures of the radius were presented as open and close fractures. In most of the cases they were transverse and oblique of one third of the distal of the body of the radius. Only in one case the fractures of the radius was at the part of the proximal epiphysis. This fracture was treated by

making the open reduction and the fixation with two 2 rods Rush put in like a crisscross.

The new fractures of the radius were treated with open reduction and internal immobilization with intramedullar rods. Only in one case of the fracture of the radius we undertook closed reduction and external immobilization with cast.

By considering the anatomic structure of the radius, the implantation of the intramedullar rods is a very difficult technique to be achieved. The medullar channel of the radius has a very narrow diameter and not uniform in its length. This feature does not allow the implantation of thick rods, whereas the narrow ones in certain cases do not ensure a rigid fixation of the bone fragments or might even break. The humeroradial articulation is relatively easy, considering the fact that the region around it is not covered with vast muscular sizes.

A retarded joint is considered when a fracture is not consolidated within the time predicted for the adherence of this fracture compared to the place of damage, the degree of the damage, and the age of the patient by regarding the preservation of the regenerating activity of the bone. [1, 3].

Factors which might influence lack of osseous regeneration might be:

- Movement of fragments
- Inclusion of soft tissues among fractured bone segments
- Incongruity of the broken osseous segments
- Infection of the focus of the fracture
- Damage of blood supply in the focus of the fracture
- General factors that damage fracture healing

Each of these is a determining factor, not only in retarding fracture healing, but also in the arise of pseudoarthrosis

The development of one form or of the other is depended on the degree of damage in the focus of the fracture from damage of perioste and the degree of traumatization of the soft tissues around them. [8].

Pseudoarthrosis or lack of joints implies a not joint and moveable fracture except for the cases when it is stable because of immobilization with strong means [12]. Pseudoarthrosis is a typical expression of the biological failure to heal the bones [14] in which the process of osteogenesis is inhibited at the stage of the fibrous callus [20]. Wrong joining or mal joining of bones is seen in case of incongruity in a direct line of the focus of the fracture [10].

Deformation of the forelimbs at the level of the forearm might influence in causing fractures of this region because of incorrect balance of the limb [10].

Another important complication noticed during fractures of the forearm bones is also osteomyelitis considered as an acute or chronic inflammatory process that affects all the osseous anatomic components [8, 10]. The microbial causes might infect the focus of the fracture in an external or hematogene way in the cases of the open fractures [9, 20]. The infection that generates at the focus of the fracture might be caused by different kinds of *Staphylococcus spp.* (especially *S. aureus*), *Streptococcus spp.*, *Pasteurella spp.*, *Pseudomonas spp.*, *Proteus*, *Klebsiella e coliforme* [18]. Suppurative infection is seen more often because of the presence of strange material which is used as means to realize osteosynthesis such as metal plates, screws, wires, etc. [9, 15].

Through this study we propose the evaluation of 34 cases in dogs with fractures of the forearm bones in order to draw conclusions for the complications of these fractures and the best technique of surgical treatment.

2. Material and methods

During the period of March 2006 - March 2010, 34 cases with a fracture of the forearm were examined in which 2 dogs manifested dual fractures. All the cases with no differentiation in breed, age sex etc underwent clinical and radiological control. After performance of osteosynthesis with blood or that conservatory defects in bones adherence re-appeared

in 5 dogs which underwent surgical treatment and external immobilization.

Clinical cards were opened for each case in which and it was written down: the kind of the fracture, the kind of surgical treatment, the technique of osteosynthesis. The period of healing and the eventual complications were evaluated during the whole process of fracture adherence.

3. Results and discussion

The dogs that were examined were 21 males and 13 females, varying from 3 months old up to 10 years old. Despite the variety of the dogs breeds for studying purposes they were separated as follows:

3.1 The Terrier Group

This grouping includes breeds that are characterized the ability to dig the ground (terraground) with a small body up to average. (the American Terrier, Pit bull, the Australian Terrier, Fox Terrier, Manchester Terrier, Miniature Schnauzer, Norfolk Terrier, White Terrier).

3.2 The Toy Group (Entertainment dogs)

Dogs of this group are characterized by the ability to play (entertain) and friendship with people and animals. (Belgian Griffon, Chihuahua, English Toy spaniel, Miniature Pinscher, Pekingese, Pug)

3.3 The Sportive Group

Sportive breeds include hunting dogs which are considerably widespread in our country. Some of them are: Pointer, Retriever, Setter, Cocker, Spaniel, Spinone Italiano.

3.4 The Guardian dog group (guard)

This mutual characteristic of this group is the ability to control migration of the herds of other animals as well as the protection of properties or people. This group is represented by: Belgian Sheepdog, Collie or Scottish Pastor, German Pastor, Rottweiler, Doberman, Siberian Husky, Samoyed.

3.5 Breeding (Metis)

This breed represents the major part of dogs in our country because of uncontrolled breeding or their origin. They are a diverse and widespread group.

The dogs' weight was different starting by 4 kg up to 45 kg.

In the major part of the cases the cause was traumatic, divided as follows: 9 fallings from the altitude, 11 car accidents, 6 duels and 8 without a known cause. From the total number of the cases 5 dogs were retreated because of lack of joints, mal joints, pseudoarthrosis and osteomyelitis.

Based on the preservation or non preservation of the integrity of the skin fractures of the forearm bones were classified as open in 12 dogs and closed in 22 dogs. Based on the fractured bones it resulted that 11 dogs with fracture of the radius or the ulna, 15 dogs with only a fracture of the radius and 8 dogs with only a fracture of the ulna.

Considering the osseous broken part 18 dogs resulted to have diaphyseal fracture, 9 dogs proximal epiphyseal fracture and 7 dogs with a distal epiphyseal fracture.

Based on the damage or non damage of the cortical part it resulted that 11 dogs had partial fracture and 23 dogs complete fracture accompanied with shift of the broken osseous segments.

The treatment of dogs with forearm fractures was carried out with the method with blood (a total of 20 dogs) by applying Steinmann intramedullar rods, Rush epiphyseal rods in the form of a crisscross as well as in oblique fractures the fixation with orthopedic wires. The treatment without blood with conservative techniques (total 14) consisted of external immobilization by using thin rods of aluminum supported with cotton, bandage and plaster.

For the 5 repeated cases the focus of the fracture was refreshing, the aseptic treatment of the wound as well as external bandaging-immobilization supported

Table 1: Data for the types of fracture according to breeds

Breeds	Type of fracture							
	Radial	Ulna	Mixed	Diaphyseal	Proximale ephyphiseal	Distal ephyphiseal	Full	Partial
<i>The Terrier Group</i>	2	1	2	2	1	-	4	1
<i>The Toy Group</i>	5	2	3	3	2	2	6	3
<i>The Sportive Group</i>	2	1	1	4	1	1	3	2
<i>The Guardian dog Group</i>	2	1	2	4	1	1	4	2
<i>Breeding (Metis)</i>	4	3	3	5	4	3	6	3
Total	15	8	11	18	9	7	23	11

Table 2: Method of treatment and healing results

Breeds	Osteosynthesis with blood		Conservative treatment		Retreatment	
	Healed	Not successful	Healed	Not successful	Healed	Euthanasia
<i>The Terrier Group</i>	2	1	2	-	1	-
<i>The Toy Group</i>	3	1	5	1	1	1
<i>The Sportive Group</i>	3	-	1	-	-	-
<i>The Guardian dog Group</i>	3	-	2	-	-	-
<i>Breeding (Metis)</i>	4	1	4	1	1	1
Total	15	3	14	2	3	2

by antibiotic-inflammatory therapy. After repetition of surgical intervention in 2 dogs severe changes were observed considering the osteolysis of the forearm bones and these cases underwent euthanasia.

By the above results it appears that the closed fractures of the forearm in dogs different from the data of [17, 1], comprise a higher percentage. Full fractures are also at a higher percentage than partial fractures as reported by [8, 10]. The highest percentage of forearm fractures in dogs is diaphyseal.

From the data of the literature high risk of mechanical movement of the fractures is reported of the forearm fractures at a distal level because of the small contact surface among broken osseous segments [9].

Healing of the forearm fractures and the prognosis depend especially on the weight of dogs and the used surgical technique [13].

As it is reported even from literature [17] the success of the surgical technique depends on a range of factors such as: the degree of damage, mobility of the focus of the fracture and the condition of the soft tissues around. Conservative treatment is considered efficient in the cases of transverse fractures accompanied by slight shift of the broken osseous

segments. This technique is not advisable for the small body breeds which are characterized by a retarded adherence of the bones. [1, 8]. The application of the endomedullar rods in these animals is successful [10]. The application of the technique with steel inoxidable plates represents an excellent technique of fixation of the diaphyseal fractures of the forearm in dogs. [11]. In these cases consolidation of the fracture and its rapid adhesion enables excellent recuperation of functioning of the damaged limb.

Defects in adhesion of broken bones of the forearm must be treated with special care. In these cases surgical treatment of the focus of the fracture is advised and external immobilization without the use of metallic devices in the focus of the fracture or close to it.

The age of the patient is a factor of special importance in choosing the technique of fixing fractures and definition of the prognosis. The size of the body of the animal is also important for the prognosis. The smaller the size of the body the more difficult healing will be, probably because of diminishing//decrease of contact surface among bone fragments. Small size body dogs need better reduction and stability. The biggest the body of the dog the least

the need to have a perfect anatomical reduction of the fracture. From dogs above 20 kg, compliance of at least half the diameter of the body of the fractured bone would be sufficient. The stability that is reached in big dogs with this degree of contact of the bone fragments is sufficient to ensure the formation of a stable callus and healing of the fracture. From dogs of small body size breeds this reduction degree ensures insufficient stability which on its behalf may cause loss of reduction with the consequence of retardation of healing or none healing of the fracture. Fractures of dogs with the growth cartilage yet open (in function) heal more rapidly than those that occur in dogs where this cartilage is closed, especially if there are big gaps in the focus of the fracture. From the experiments it has resulted that dogs with open growth cartilages are able to recuperate loss of the osseous size in the focus of the fracture, which in animals with closed growth cartilage would cause retarded healing or not healing at all. In this way the combination of age with the size of the body of the animal enables the chosen way of fracture treatment changes according to the individual characteristics of the patient. Intramedullar rods are used with good results in the breeds of the big body size dogs but the problem with this technique is related to the ultimate position of the rod. Emergence of the rod through the articulation causes its damage, a damage which continues even after removal of the rod. In some fractures the technique of fixation through thin crisscrossed rods which are also combined with the wire joints in the form of the number eight. Another technique of fixing with intramedullar "buried" rods was used because it avoids damage of articulations, but has as a disadvantage the disability to remove the intramedullar rod if there arises a need for such intervention (for example in the cases of osteomyelitis). By internal fixation complications such as retarded joining or lack of joints because of the inappropriate technique used, are not avoided. Defective adherences as a result of rotation of bending might occur if a single Steinmann rod is used, or if the

device is removed before fracture healing occurs. Breaking of the metallic devices might occur because of defective placement or non using transplants of the spongy bone. If the operation lasts in time, infection might appear. Removal of the intramedullar rods through distal articulation might cause arthritis, whereas emergence from its proximal part causes the creation of open wounds and osteomyelitis. The wounds formed in these cases are medicated as common wounds while precautions are taken to ensure stability of the broken region as well as calmness of the focus of the fracture.

Conclusions

From this retrospective study we might draw several important conclusions:

- Considering the conditions in which dogs are kept they are exposed to mechanical traumatic actions with bone fracture consequences.
- Care for the traumatized patient consists in the preservation of functions with life importance and later with fracture repair.
- Adherence or regeneration of the bone requires to consider two main principles:
- reduction or occlusion of the fractured bone fragments
- fixation or immobilization of the focus of the fracture
- surgical techniques for the healing of the forearm fractures are:
- osteosynthesis with blood
- external immobilization
- Osteosynthesis with blood through placement of the intramedullar rod is more successful compared to external immobilization.
- Radiologic control is an important help and must accompany the whole process of fracture healing.
- Surgical manipulations in bones must be performed in extremely sterile conditions in contrary cases healing of the fracture are under risk.

- In the simple and close fractures, especially fractures of the ulna, external immobilization might be used.
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