International Journal of Livestock Research, Vol. 11 (9) Sep' 2021
http://www.ijlr.org
eISSN: 2277-1964

Original Research

Incidence, Occurrence and Classification of Tibial Diaphyseal Fractures in Dogs

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[1]*Part of Doctoral thesis, submitted to PVNRTVU, Hyderabad

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How to cite this paper: Sumiran, N., Rao, T., Latha, C., Kumar, D., & Lakshman, M. (2021). Incidence, Occurrence and Classification of Tibial Diaphyseal Fractures in Dogs. *International Journal of Livestock Research*, 11(9), 9-15. https://dx.doi.org/10.5455/ijlr.20210615103006

Received : Jun 18, 2021
Accepted : Jul 11, 2021
Published : Sep 30, 2021

Abstract

A survey was undertaken to analyse tibial diaphyseal fractures in dogs reported to Department of Veterinary Surgery and Radiology, College of Veterinary Science, Rajendra Nagar, PVNRTVU, Hyderabad, India over a period of two years from January 2018 to December 2020. A total of 157 long bone fractures were reported with highest incidence of pelvic limb fractures (63.69%). Femoral (30.57%) and tibial (33.12%) fractures showed equal distribution with slightly higher incidence of tibial bone fractures. Mid diaphyseal fractures (77.78%) of tibia were common. Incidence was highest in non-descriptive breed dogs (39%) and dogs of young age (55.56%) with a body weight of 5-10 Kgs (27.78%). Male dogs (66.67%) were commonly affected than female dogs (33.33%). The common etiological factor of fracture was automobile accidents (38.89%). Simple fractures (88.89%) were more common and among simple fractures, oblique fractures (50%) showed higher incidence.

Keywords: Dog, Fracture, Incidence, Tibial diaphysis

Introduction

Bone fractures represent the most common major problem in pet animals, particularly in dogs (Raouf *et al.*, 2019). Non-physiological forces occurring in unusual situations such as automobile accidents, gun-shot injuries and fall from height result in fracture. When the forces transmitted to the bone directly exceed the ultimate strength of the bone, fracture is seen. Velocity of the forces causing the fracture dictates the number of fragments and the damage to surrounding soft tissues (Fossum, 2019).

A study was carried out with the objectives of determining the incidence of fractures, types of fractures and their frequency of occurrence in long bones with special reference to tibial diaphyseal bone in dogs presented over a period of two years.

Materials and Methods

A total of 157 dogs with long bone fractures presented to Department of Veterinary Surgery and Radiology, College of Veterinary Science, Rajendra Nagar, PVNRTVU over a period of two years from January 2018 to December 2020 were investigated. Information regarding the primary cause of fracture, age, sex, breed and size of the animal, bone involved and the type of the fracture was collected. Dogs were divided into four age groups: Juvenile (less than one year old), young adult (between one and three years), mature adult (between three and ten years) and geriatric (above 10years) (Shearer, 2011). In relation to size, the dogs were classified as small (less than15 Kg), medium (15-25 Kg), large (greater than 25 Kg). Two orthogonal radiographs were taken to study the location and type of fracture. Regarding anatomical location, fractures were classified as epiphyseal, metaphyseal and diaphyseal (proximal, middle and distal) fractures (Muller *et al.*, 1990).

Results and Discussion

Of these 157 long bone fractures, fractures involving humerus accounted for 10.83 per cent, radius-ulna - 25.48 per cent, femur - 30.57 per cent, and tibia-fibula 33.12 - per cent (Table 1). The highest incidence was found in pelvic limbs (63.69%) followed by pectoral limbs (38.22%) (Table 2). Kumar *et al*. (2007) and Aithal *et al*. (1999) also reported higher incidence of pelvic limb fractures among long bone fractures. This highest incidence of pelvic limb fractures might be due to more exposure of hind limbs to the major force of impact. a trauma to the caudal half of the animal would be less likely to produce life-threatening injury, and such animals may be presented for treatment more frequently (Harasen, 2003).

Table 1: Bone wise distribution of fractures

Name of the Bone	No. of Animals	Per cent
Humerus	17	10.83
Radius-ulna	40	25.48
Femur	48	30.57
Tibia-fibula	52	33.12

Table 2: Limb wise distribution of fractures

Name of the Bone	No. of animals	Per cent
Pectoral limbs	57	36.31
Pelvic limbs	100	63.69

In our study, femoral and tibial bone fractures showed equal distribution but with slightly higher incidence of tibial bone fractures (Roush, 2015). Whereas, Kumar *et al*. (2007), Simon *et al*. (2010), Libardoni *et al*. (2016) and Jain *et al.* (2018) reported equal distribution of fractures among femur and tibia but with slightly higher incidence in femur bone. The high incidence of femur fractures might be attributed due to the length of femur which is two quarters of the hind limbs therefore having greater and easier exposure to the impact force (Keosengthong *et al.*,

2019).

Among the tibial fracture cases, tibial diaphyseal fracture cases accounted for 73.08 per cent, whereas 26.92 per cent cases constituted epiphyseal, physeal and metaphyseal fractures (Table 3). These findings were similar to Guiot and Dejardin (2011) and Brinker *et al*. (2016) who reported diaphyseal fractures as per cent and 75-81 per cent respectively. Among these total tibial diaphyseal fractures (n = 38), 9 cases have multiple bone fractures, 11 cases have neurological disorders and 18 cases were found healthy and suitable for surgical treatment. Out of these 18 tibial diaphyseal fracture cases, midshaft diaphyseal fractures were recorded in 14 cases, whereas proximal and distal diaphyseal fractures were recorded in one case and 3 cases respectively (Table 4). Similar findings were reported by Hayashi and Kapatkin (2018) and Raouf *et al*. (2019). On contrary Ozsoy and Altunatmaz (2003) found more number of distal diaphyseal fractures followed by mid diaphyseal and then proximal diaphyseal fractures of tibia in dogs. Mid diaphysis and distal diaphysis were subjected to greater stress during a fall or injury resulting in fractures (Harasen, 2003).

Table 3: Incidence of tibial fractures based on anatomical location

Location of the Bone (Tibia)	No. of Animals	Per cent
Diaphysis	38	73.08
Metaphysic	9	17.31
Physis	2	3.84
Epiphysis	3	5.77

Table 4: Incidence of tibial diaphyseal fractures based on anatomical location

Location of the Bone (Tibia)	No. of Animals	Per cent
Proximal diaphysis	14	77.78
Mid diaphysis	1	5.56
Distal diaphysis	3	16.67

Of these 18 tibial diaphyseal fracture cases, right tibial fractures constituted 55.55 per cent, whereas left tibial fractures constituted 44.44 per cent (Table 5). The findings were similar to findings of Simon *et al*. (2010) and Singh *et al*. (2015). However, Aithal *et al*. (1999) reported equal distribution of fractures in both limbs. The reason for more involvement of one limb could not be explained.

Table 5: Incidence of tibial diaphyseal fractures based on the side of the limb

Side of the Limb	No. of Animals	Per cent
Right tibia	10	55.55
Left tibia	8	44.44

In relation to breed, highest incidence was seen in non-descriptive breed followed by Labrador Retriever, Pomeranian, German Shepherd, Great dane, Dachshund, Pug and Saint Bernard (Table 6). These findings were in accordance with the findings of Simon *et al*. (2010), Singh *et al*. (2015), Libardoni *et al*. (2016) and Jain *et al*. (2018) where as Eyerefe and Oyetayo (2016), Raouf *et al*. (2019) reported highest incidence in German Shepherd dogs. In the present study, higher incidence in non-descriptive dog breed might be due to higher population and free-living nature of these dogs making them prone to automobile accidents (Aithal *et al*., 1999). However, variation of incidence of bone fractures in different breeds of dogs may be related to owner living regions/countries which may differ in behaviour/ life styles in different countries Keosengthong *et al*. (2019).

Table 6: Breed wise incidence of tibial diaphyseal fractures

Name of the Breed	No. of Animals	Per cent
Non-descriptive breed	7	38.89
Labrador Retriever	4	22.22
Pomeranian	2	11.11
German Shepherd	1	5.56
Great Dane	1	5.56
Dachshund	1	5.56
Saint Bernard	1	5.56

In relation to size of the dogs, the incidence was highest in medium breeds (66.67%) followed by small breeds (22.22%) and large breeds (11.11%) (Table 7). Highest incidence in medium sized breeds might be due to more number of non-descriptive breed dog population.

Table 7: Incidence of the tibial diaphyseal fractures based on size of the breed

Size of the Breed	No. of Animals	Per cent
Small size breeds	4	22.22
Medium size breeds	12	66.67
Large size breeds	2	11.11

In our study, the incidence of tibial fractures was high in dogs weighing 5-10 Kgs (27.80%) followed by 20-30 Kgs (22.22%), 30-40 Kgs (22.22%), < 5 Kgs (16.67%) and 10-20 Kgs (11.11%) (Table 8). However, some authors reported highest incidence of tibial fractures in dogs weighing 10-25 Kgs (Keosengthong *et al*., 2019), < 5 Kgs (Libardoni *et al*., 2016) and 11-20 Kgs (Singh *et al*., 2015). In our study, the highest incidence of tibial fractures in dogs weighing 5-10 Kgs might be due to the presentation of more number of young puppies of medium sized breeds.

Table 8: Incidence of the tibial diaphyseal fractures based on weight of the breed

Weight of the Breed	No. of Animals	Per cent
< 5 Kgs	3	16.67
5 - 10 Kgs	5	27.78
10 - 20 Kgs	2	11.11
20 - 30 Kgs	4	22.22
30 - 40 Kgs	4	22.22

In the present study, highest incidence was seen in the dogs below one year age (55.56%) (Table 9). Similar findings were reported by Simon *et al*. (2010), Singh *et al*. (2015), Eyerefe and Oyetayo (2016) and Keosengthong *et al*. (2019).

Table 9: Age wise incidence of tibial diaphyseal fractures

Age of the Dog	No. of Animals	Per cent
Less than one year	10	55.56
1 - 3 years	6	33.33
3 – 10 years	2	11.11

Young dogs were more prevalent as they were under development, with low density bones in osteogenesis phase, which can be fragile even for injuries of lower intensities (Minar *et al*., 2013) and also the young ones are more active and are not learned to cope up with hazards unlike their older counterparts (Aithal *et al*., 1999). The naivety

of young animals to avoid danger from on-coming vehicles when wandering around in an un-fenced environment also makes them prone to orthopaedic injuries (Adeyanju *et al*., 1988). Young dogs have phobia for kennel confinement and often sleep under owner's vehicles making them prone to orthopaedic injuries. Besides many dog owners are not familiar with breed associated nutritional requirements for healthy bone formation and maintenance, and this information is not usually provided by breeders. A consequence of this might be an upsurge in the incidence of nutritional osteopathies among young and growing dogs (Eyerefe and Oyetayo, 2016).

During the present study, tibial fractures were more commonly reported in male dogs (66.67%) than female dogs (33.33%) (Table 10) similar to Simon *et al*. (2010), Singh *et al*. (2015), Eyerefe and Oyetayo (2016), Libardoni *et al*. (2016), and Keosengthong *et al*. (2019). This may be attributed to the fact that males are more aggressive and tend to wander more than female counterparts, thus more vulnerable to fracture (Aithal *et al*., 1999). Further people have a preference for male dog due to different reasons than a female dog resulting in the increase in the share of male animals in the total population, therefore more number of male dogs were presented with fracture than female dogs (Singh *et al*., 2015). Males in search of females in heat make them exposed to accidents or to be involved in fights with other males (Libardoni *et al*., 2016).

Table 10: Sex wise distribution of tibial diaphyseal fractures

Sex	No. of Animals	Per cent
Male dogs	12	66.67
Female dogs	6	33.33

The main etiological factor for tibial fractures was automobile accident (38.89%) followed by dog bite (27.78%), fallen from height (11.11%), human abuse (11.11%) and miscellaneous cause (11.11%) (Table 11). Ali (2013), Singh *et al*. (2015) Eyerefe and Oyetayo (2016), Keosengthong *et al*. (2019) and Lalzawmliana *et al.* (2019) also recorded high incidence of fractures due to automobile accidents. This might be due to more number of non-desciptive breed dogs which were usually let loose to roam outside freely and thus more likely to succumb to road accidents (Maala and Celo, 1975). Libardoni *et al.* (2016) stated that the reason for high incidence of automobile accidents might be due to increased access to public roads and due to the owners who omit containment measures and protection in their homes and during rides.

Table 11: Etiology of tibial diaphyseal fractures

Cause of Fracture	No. of Animals	Per cent
Automobile accidents	7	38.89
Dog bite	5	27.78
Fallen from height	2	11.11
Human abuse	2	11.11
Miscellaneous cause	2	11.11

Fracture classification had a great use in referral cases by saving the time required for radiographic evaluation of the affected limb and aided in planning immediate fracture fixation (Raghunath *et al*., 2007). In the present study, simple fractures (88.89%) were highly reported and then the wedge fractures (11.11%). Among these simple fractures, Oblique fractures (50%) were commonly seen followed by spiral fractures (25%) and transverse fractures (25%) (Table 12). This is in agreement with the findings of Aithal *et al*. (1999) and Das (2010) who reported high incidence of simple oblique fractures whereas Harasen (2003), Kallianpur *et al*. (2018) and Keosengthong *et al.* (2019) reported high incidence of simple transverse fractures. Higher incidence of oblique/transverse fracture indicates that the predominance of bending or compression forces were the cause of fracture (Smith, 1985). In the present study, the incidence of closed fractures (66.67%) was high when compared to open fractures (33.33%) (Table 13) similar to the findings of Ozsoy and Altunatmaz (2003).

Table 12: Classification of tibial diaphyseal fractures

Type of Fracture	No. of Animals	Per cent
Transverse fractures	4	22.22
Spiral fractures	4	22.22
Oblique fractures	8	50
Wedge fractures	2	11.11

Table 13: Distribution of open and closed fractures

Type of Fracture	No. of Animals	Per cent
Closed fracture	12	66.67
Open fracture	6	33.33

Conclusion

From the present study, it is concluded that the common profile of dogs with fractures in Telangana region is: male dogs, medium sized non-descriptive breed, young dogs of below one year age with body weight of 5 – 10 Kgs, mid diaphyseal tibial fracture due to automobile accident.

Conflict of Interests

There is no conflict of interest.

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