



Configuration of Long Bone Fractures in Canines - Clinical Study of 151 Cases

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ABSTRACT: Fractures in dogs can be categorised based on clinical information and radiographic appearance of the fracture. Fracture classification systems like AISF /AO serve as an integral role in elucidating fracture biomechanics, predicting associated soft tissue trauma, and formulating an optimal fixation plan. Based on non-weight bearing lameness on affected limb, aberrant angulation of the limb at the site of fracture, oedema and crepitation at the site of fracture and pain on palpation fracture configuration is done. This is important for the selection of treatment modality.

KEY WORDS: Fracture dogs' classification AISF/AO

INTRODUCTION

Fractures of long bones are more common because of traumatic injuries. Fractures in dogs can be categorized based on multiple parameters, each providing critical information for precise description, fixation planning, and preoperative decision-making to select the most appropriate therapeutic strategy (Decamp, 2016). Fracture classification systems serve as an integral role in elucidating fracture biomechanics, predicting associated soft tissue trauma, and formulating an optimal fixation plan. Furthermore, the use of standardized fracture classification systems provides a consistent framework for describing fracture characteristics, thereby promoting uniform and precise communication among clinicians and researchers. Such standardization enhances the reproducibility of clinical observations, supports evidence-based therapeutic decision-making, and enables objective comparison of treatment outcomes, complication rates, and prognostic indicators across various studies and clinical environments.

MATERIALS AND METHODS

The present study was conducted to classify long bone fractures presented to Teaching Veterinary Clinical Complex and Department of Veterinary Surgery & Radiology, over a period of 18 months (May 2023 to October 2024). The complete history and signalment of each case were recorded, and the presented fractures were categorized according to established classification systems. The common symptoms seen in the patients of the current investigation included non-weight bearing lameness on affected limb, aberrant angulation of the limb at the site of fracture, oedema and crepitation at the site of fracture and pain on palpation. A detailed clinical and orthopaedic examination was performed to evaluate the general health status and musculoskeletal integrity of the affected dogs. Preoperative radiographic examinations in two orthogonal views i.e. cranio-caudal and medio-lateral projections determined the precise location, configuration, and type of fracture for subsequent classification and treatment planning and for elucidating the prognosis.

Several classification standards have been described for fractures. An ideal fracture classification system should provide guidance for treatment, indicate possible complications and thus make prognostic predictions for the fracture. The presented fractures were classified using AO/ASIF, Winquist-Hansen, Rhangani classification so as to plan the best treatment.



On the basis of radiological observations, the fractures were classified as per AO VET (Association for osteosynthesis)/ASIF (American association of internal fixation.) alphanumeric morphological fracture classification system (Unger et al.1990) using a four characters alpha-numeric code. This system takes into consideration the bone affected, the region and type of fracture line. The character locates the bone (1-Humerus, 2--Radius/Ulna, 3 --Femur, 4 -- Tibia-fibula) and second character designates the segment of the bone that is fractured (1-proximal, 2-diaphyseal, 3-Distal). The fracture morphology is described using the letters A, B, C as A- simple, B-wedge fracture and C-complex fracture. Each grade is further grouped into three degrees of complexity (eg A1, A2, A3) depending upon the extent of bone fragmentation.

The grading of fracture was done according to the degree of comminution as per Winquist-Hansen classification (Winquist et al, 1984) as : Grade 0- no communication, two piece fracture; Grade1-one small unimportant bone chip; Grade 2 -- > 50% contact between major proximal and distal fracture fragments; Grade 3 -- < 50% contact between major proximal and distal fracture fragments ; Grade 4- no contact between major proximal and distal fracture fragments ; and Grade 5—segmental fracture , no contact between major proximal and distal fracture fragments.

The fracture classification mentioned by Rhangani (2014) i.e. short oblique, transverse, long oblique and comminuted fractures was also followed.

RESULTS & DISCUSSION

The common symptoms seen in the patients of the current investigation included non-weight bearing lameness on affected limb, aberrant angulation of the limb at the site of fracture, oedema and crepitation at the site of fracture and pain on palpation.

According to AO/ASIF classification, among 151 long bone fractures, highest number of fractures were simple transverse diaphyseal fracture of radius and ulna (22A3) recorded in 20.53% of cases followed by diaphyseal oblique fracture of femur (32A2) in 15.89% of cases.

In femur, simple diaphyseal (32A) fractures were recorded highest in 58.2% of cases followed by distal extra articular (33A) in 14.92% of cases and diaphyseal complex segmental (32C) in 11.94% of cases of total femoral fractures, suggesting that bending or compressive forces are the most common etiological factors in canine long bone fractures. In radius & ulna simple diaphyseal (22A) fractures were recorded highest in 88.62% of cases followed by equal number of cases in diaphyseal complex (22C) and distal extraarticular (23A) in 4.74% of cases. Out of 26 tibial fractures, simple diaphyseal (42A) were recorded highest in 84.6% of cases and in humerus simple diaphyseal (12A) were recorded highest in 57.14% of cases. The four most common fracture classes 12A, 22A, 32A, 42A which were reported earlier by Miller et al. (1998), Raghunath et al. (2007), Kallianpur et al. (2018), Priyanka et al. (2019), Singh et al. (2022) and Gaddam et al. (2022) mirrored the findings of present study. (Table 2). According to Gaddam et al. (2022), this type of fracture categorization was very helpful in referral cases as it gave an idea about the possible forces that played in the formation of such fractures, suggesting the correct implant that can be used to combat these forces during intra and post-operative period till the fracture healed completely.

Table 2: AO/ASIF Classification of long bone fractures in dogs (n=151)

S.No	AO/ASIF Code	No	% of total cases	Bonewise %	Type of fracture
I	HUMERUS				
1	12A2	3	1.98	21.43	Diaphyseal simple oblique fracture
2	12A3	5	3.31	35.71	Diaphyseal simple transverse fracture
3	12B1	1	0.66	7.14	Diaphyseal fracture with one reducible wedge
4	12C2	1	0.66	7.14	Diaphyseal complex segmental fracture
5	12C3	1	0.66	7.14	Diaphyseal complex fracture with nonreducible wedges
6	13A1	2	1.32	14.28	Distal extraarticular simple fracture
7	13C1	1	0.66	7.14	Distal complete articular simple, metaphyseal simple fracture
	Total	14	9.25		



II					
RADIUS-ULNA					
1	21A3	1	0.66	2.27	Proximal extraarticular fracture of both radius and ulna
2	22A1	1	0.66	2.27	Diaphyseal incomplete fracture of radius, ulna intact
3	22A2	7	4.63	15.90	Diaphyseal simple oblique fracture of both radius and ulna
4	22A3	31	20.53	70.45	Diaphyseal simple transverse fracture of both radius and ulna
5	22C2	1	0.66	2.27	Diaphyseal complex fracture of radius, ulna simple
6	22C3	1	0.66	2.27	Diaphyseal complex fracture of both radius and ulna
7	23A2	1	0.66	2.27	Distal extraarticular simple oblique fracture of radius and ulna
8	23A3	1	0.66	2.27	Distal extraarticular simple transverse fracture of radius and ulna
	Total	44	29.12%	99.97%	
III					
FEMUR					
1	31B1	1	0.66	1.49	Proximal extra articular basicervical fracture
2	31B2	2	1.32	2.98	Proximal extra articular transcervical neck fracture
3	31C1	1	0.66	1.49	Proximal articular simple head fracture
4	32A1	1	0.66	1.49	Diaphyseal simple incomplete fracture
5	32A2	24	15.89	35.82	Diaphyseal simple oblique fracture
6	32A3	14	9.27	20.89	Diaphyseal simple transverse fracture
7	32B1	2	1.32	2.98	Diaphyseal spiral wedge fracture
8	32B2	2	1.32	2.98	Diaphyseal multiple wedge fracture
8	32C2	4	2.65	5.97	Diaphyseal complex segmental fracture
9	32C3	4	2.65	5.97	Diaphyseal complex fracture with non reducible wedges
10	33A1	7	4.63	10.44	Distal extra articular simple fracture
11	33A2	3	1.98	4.48	Distal extra-articular fragmented wedge fracture
	Total	67	44.33%	99.97%	
IV					
TIBIA-FIBULA					
1	42A1	1	0.66	3.84	Diaphyseal simple incomplete fracture
2	42A2	14	9.27	53.84	Diaphyseal simple oblique fracture
3	42A3	7	4.63	26.92	Diaphyseal simple transverse fracture
4	42B1	1	0.66	3.84	Diaphyseal fracture with one reducible wedge
5	42C1	1	0.66	3.84	Diaphyseal complex fracture with reducible wedges
6	43A1	1	0.66	3.84	Distal extra articular simple fracture
7	43C2	1	0.66	3.84	Distal complete articular simple, metaphyseal multi fragmentary fracture
	Total	26	17.20%	99.96%	

According to Winquist-Hansen classification, out of 151 fractures cases, 58 were grade I (39.45%) followed by grade 0 (29.93%), equal number of cases in grade II and grade IV (10.20%) and grade V (3.40%). Details of classification was shown in Table 3 and Fig. 2. This is in accordance with Gaddam et al. (2022), who reported that majority of grade I fractures. On contrary, Gondalia and Siddiqui (2015) reported high incidence of grade II fractures in dogs.



Table 3: Winquist-Hansen Classification of long bone fractures in dogs (n=151).

S.No	Grading of fracture	Number	Percentage
1	Grade 0	44	29.93
2	Grade I	58	39.45
3	Grade II	15	10.20
4	Grade III	10	6.80
5	Grade IV	15	10.20
6	Grade V	05	3.40
	Total	147	99.98%

In the present study, according to Rhangani (2014), highest number of fractures were transverse fractures (46.35%) followed by oblique fractures (35.09%), comminuted and wedge fractures (7.94% each) and incomplete fractures (2.65%). Details of orientation of long bone fractures were shown in table and fig . Similar findings were observed according to Jain *et al.* (2018), Kallianpur *et al.* (2018), Keosengthong *et al.* (2019), Abo-Soliman *et al.* (2020), Bidari *et al.* (2023) and Kumar *et al.* (2023). Highest incidence of transverse/oblique fractures in the present study may be due to bending or compressive forces as the cause of fracture. The highest number of transverse fractures (20.53% of cases) was observed in the radius and ulna, may be attributed to the anatomical structure, as their thinner and narrower mid-shaft regions make them more susceptible to such fractures

Table 1: Fracture configuration of long bone fractures in dogs (n=151) (Rhangani's Classification)

S.No	Fracture configuration	Number	Percentage
1	Transverse fracture	70	46.35
2	Oblique fracture	53	35.09
3	Comminuted	12	7.94
4	Wedge	12	7.94
5	Incomplete	4	2.65
	Total	151	99.97%

CONCLUSION

The AO/ASIF classification system proved to be an effective tool for categorizing diaphyseal fractures exclusively based on their anatomical location and morphology, facilitating precise diagnosis, communication, and surgical planning. The preoperative availability of proper classification ultimately contributed to improved prognostic assessment and standardization of fracture management in veterinary practice.

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