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Research Article

A Retrospective Study of the Incidence, Age, Breed Predisposition and Types of Fractures in Household Dogs in Nairobi County, Kenya

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ABSTRACT

A retrospective study was conducted between January 2014 and September 2016 within Nairobi County, Kenya and its environs to determine the prevalence of appendicular bone fractures in household dogs. Dogs being popular companion animals worldwide, have led to an increased number of dogs being kept as pets, thus, making them vulnerable to appendicular bone fractures. A study was conducted to determine the incidences and spatial distribution of appendicular bone fractures among household dogs. A total of 220 cases of fractures were randomly collected from veterinary clinics within the study area through retrieving all case records between January 2014 and September 2016. The overall incidence of bone fracture was 15% and the prevalence of the appendicular bone fractures was 76%. Highest bone fracture was recorded in males (62%), 7-14 months of age (33%), femur (22%) and medium breeds of dogs (6-10kgs) (41%). The principle cause of appendicular bone fractures was observed to be vehicle accidents at 40%. The therapeutic intervention employed included external and internal fixation techniques, Plaster of Paris and intramedullary pins. Secondary infection, non-compliance of the owner, mal-union, non-union, cast bandage, plates and pin dehiscence's, cost implications and death of the patients during surgery were among the most observed bone fracture management challenges. This study concluded that household dogs sustain appendicular bone fractures, hence, there is need to encourage adoptions of digital modes of data storage, improve on surgical skills via targeted training, improve on facilities and provision of necessary surgical instruments, and encourage specializations among the veterinary professionals.

Key words: Dogs, Appendicular Bone Fracture, Study, Prevalence

INTRODUCTION

Worldwide, dogs are the majority of companion animals and an industry of economic importance such as sales of animals, pet food, sales of equipment, animal health services, sales of veterinary services and activities generate money flow like dog shows (Marguerite, 2010). Kenya in the recent past has attracted pet ownership especially in Nairobi County and its environs, and major towns (Rhangani *et al*., 2014). However, household dogs are prone to appendicular bone fractures due to exposure to external traumatic agents, internal agents like nutritional deficiency, hormonal imbalances and bone pathology (tumors and infectious conditions) (Rubin *et al*., 2015). Furthermore, irrespective of the causative agents of fractures, the outcome of the fractures interferes with the normal functions of the bone, incurred expenses in treating and managing the fracture, and associated conditions like soft tissue, organs and ligament damage (Perry and Bruce, 2015)

The incidence of forelimb fractures is higher compared to hind limb fractures as the dogs bear more weight on the thoracic limbs. Fractures arise due to high energy trauma, therefore severe and permanent disabilities, and severe life threatening injuries are sustained (Fox, 1997; Rhangani *et al*., 2014). Canine skeletal maturation occurs at 5 months of age in toy breeds and 18 months of age in giant breeds, therefore both structural and biochemical properties of developing bone have low strength and stiffness (Julkunen *et al*., 2009).

Fracture cases are encountered mostly in male dogs than female dogs because male dogs are known to be aggressive and tend to roam for longer distances, hence have a higher chance of being exposed to external etiological agents like accidents (Aithal *et al*., 1999b; Dvorak *et al*., 2000; Senn *et al*., 2004). Younger household dogs between 1.5 months to 6 months of age, are known to be active, playful and unaccustomed to environmental risk factors thus are much exposed to

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appendicular bone fractures (Shiju *et al.*, 2010; Shiju *et al.*, 2011; Vidane *et al.*, 2014).

Therefore, broad understanding of fractures, wider knowledge on methods of fracture intervention and proper description of the type of fracture are the key factors in improving fracture management and intervention skills (Aithal *et al.*, 1999a). Current information on the incidence, etiology, management options and outcomes of appendicular bone fractures in Kenya is scanty. The information gaps prompted the study.

MATERIALS AND METHODS

The study area selection

The study was done within Nairobi county and its environs. Nairobi being the capital of Kenya, is located between Kampala and Mombasa, at 1^0 09' S 36^0 39' E and 1^0 27' S 36^0 06' E, occupying 696 square kilometers. It is situated adjacent to the Eastern edge of Rift Valley, Ngong Hills to the West, Mount Kenya to the North and Mount Kilimanjaro to the south east of the city. It has subtropical highland climate, under Koppen climate classification, 1795 meters (5889 feet's) above the sea level, June and July season are cool where temperature drop to 9^0 C (48^0 F) while December and March season are the sunny and warm with a mean temperature of 24^0 C (75^0 F). Nairobi County has national and international securities exchange, overseas stock exchange, and regional headquarters of many companies and organizations, hence enjoy a luxurious financial status attacking high population of household dogs, thus intense veterinary practices are carried out.

The protocol of data collection

A retrospective study was done to obtain the trend and incidence of appendicular bone fractures in Nairobi County and its environs from January 2014 to September 2016. The study involved retrieval of recorded data on bone fractures and selection of X-rays records from eight (8) Small Animal Veterinary Clinics. Recorded cases were reviewed and a questionnaire was designed and administered in the eight (8) randomly and purposely selected veterinary clinics. Information collected for analysis included; breed, age, gender, spayed/neuter status, fracture age, location and type; diagnostic tools, treatment options and follow ups, complications and outcomes.

RESULTS

A total of 220 cases diagnosed with bone fractures were obtained and out of these, 168 cases had a history and radiographic confirmatory diagnosis of appendicular bone fractures. There were 1470 recorded cases over the period. The prevalence of bone fractures was therefore estimated at 15% (220/1470), Appendicular bone fractures had the highest prevalence at 76% (168/220) followed by vertebral bone, pelvic and scapula fractures at 24% (52/220) during the 2-year study period (2014-2016).

Male dogs had the highest bone fracture incidence than female dogs. The entire males had 43% (91/210), entire females 24% (39/210), neutered males 19% (51/210) and neutered females 14% (30/210) (Figure 1).

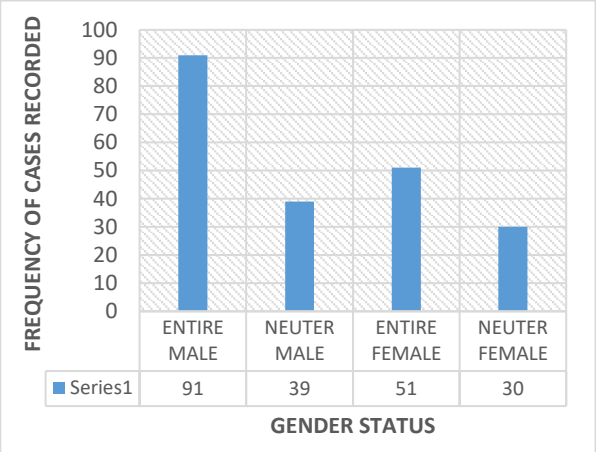

Fig. 1: Distribution of appendicular bone fracture cases recorded based on spayed/neuter status.

The incidence of breed predispositions based on the weight; 6-10kgs 41% (87/210), above 21 kgs 21% (43/210), 1-5 kgs and 11-20kgs 19% (40/210) (Figure 2).

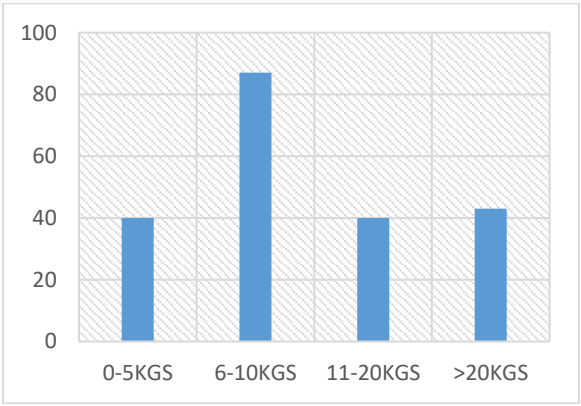

Fig. 2: Breed predisposition to appendicular bone fracture in dogs based on weight.

The study found out that ages below 14 months were more predisposed to bone fractures. Age between 7 and 14 months 33% (68/210), 0-6 months 28% (59/210), 15 months-5 years 22% (47/210) and above 6 years 17% (36/210) (Figure 3).

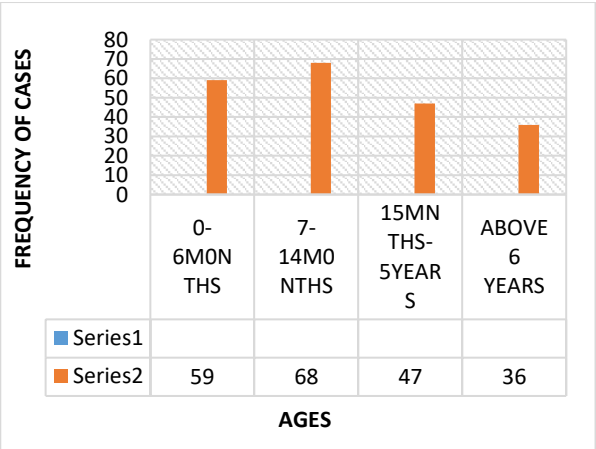

Fig. 3: Distribution of prevalence of various age group with appendicular bone fracture.

Majority of the bone fractures were associated with intrinsic factors; vehicle accidents 40% (85/210), fallen from height 29% (61/210), dog bites 17% (35/210), unknown causes 11% (22/210), other causes 2% (5/210), animal accidents 1% (1/210) and malicious causes 0% (1/210) (Figure 4).

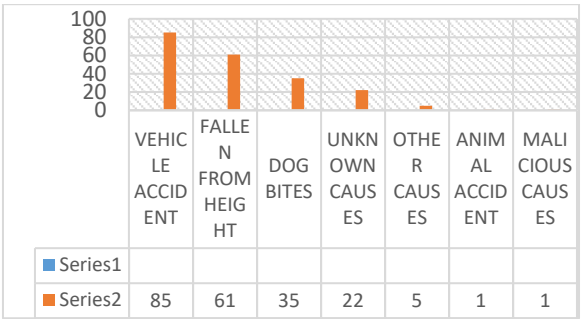

Fig. 4: Distribution of frequency of the most prevalent causes that result in appendicular bone fractures.

The incidences and trends of various bone fracture are illustrated in figure 5. The ulna and radial 27% (46/168), femoral fractures 28% (46/168), tibia and fibula 17% (29/168), humeral fractures 10% (17/168), phalanges 8% (13/168), metacarpus and carpus 4% (7/168), metatarsus 1% (2/168) and tarsus 1% (1/168).

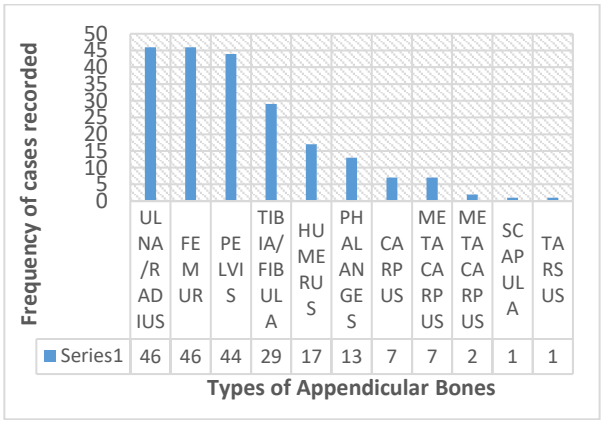

Fig. 5: Fracture cases recorded in the appendicular bones fractures

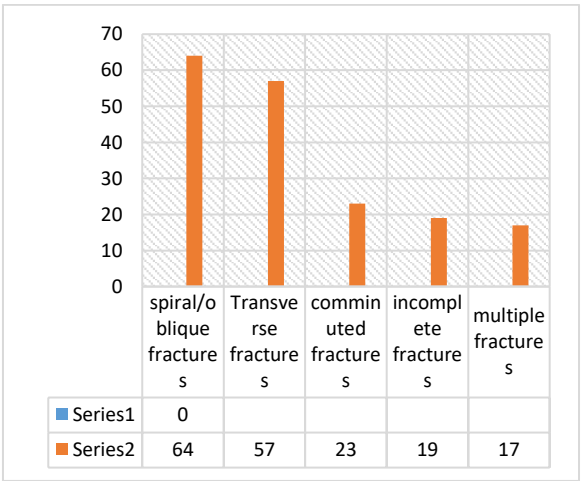

Fig. 6: Bone fracture type description based on fracture line.

The description of various bone fractures is based on the direction of the fracture line as illustrated by figure 6. The study revealed that spiral/oblique fractures 36% (68/180), transverse fractures 32% (57/180), comminute fractures 13% (23/180), incomplete fractures 10% (19/180) and multiple fractures 9% (17/18).

The study found out that internal fixation was the most preferred method of fracture management in dogs which included: intramedullary pins and cerclage wires, bone plates and screws. The most common fracture management approach for long bone fractures; femur, tibia/fibula, humerus and ulna/radius, involved a combination of both internal and external fixation methods (Table 1).

DISCUSSION

According to the study findings, younger household dogs below the age of 14 months old were more predisposed to appendicular bone fractures. This was comparable to a previous study done by Shiju *et al*. (2010) who observed a higher incidence of bone fractures in dogs aged between 1.5 to 6 months old. This can be due to the fact that dogs in this age group are playful, active and unaccustomed to the environment they are living in (Shiju *et al*., 2010; Shiju *et al*., 2011; Vidane *et al*., 2014) and reported that abnormal bone growth occurs among rapidly growing dogs, as well slowly growing dogs has a significant effect and bearing excessive weight on fore limbs, thus predisposing them to fractures.

The study finding demonstrated breed predisposition: medium breed (6-10 kgs) 42%, breed above 21kgs 20%, toy breeds (1-5kgs) 19% and large breeds (10-20kgs) 19%, which was similar to a previous study by Jukunen *et al*. (2009) who argued that canine maturation occurs at 5 months old in toy breeds and 18 months old in giant breeds, therefore structurally and biochemical properties of developing bone have low strength and stiffness.

In the current study, gender was among the predisposing factors where higher incidence was recorded in male dogs, bone fracture 62% (130/210) than females 38% (81/210). However, entire dogs have higher a predisposition to fractures than neutered dogs This finding was similar to reports elsewhere (Aithal *et al*., 1999a; Dvorak *et al*., 2000; Senn *et al*., 2004; Rhangani *et al*., 2014) in which male dogs had higher incidences of fractures than females because males are known to be more aggressive and tend to roam for longer distances, exposing them to external etiological agents, including trauma, fights, fallen from heights ballistic missiles and gunshots (Simpson, 2004; Kumar *et al*., 2007; Ben Ali *et al*., 2013; Elzomor *et al*., 2014).

The findings of this study revealed that extrinsic factors are the major etiological agents of bone fractures in dogs. These include; motor vehicle accidents, falling from height and dog bites. These findings were consistent with those in other studies elsewhere (Simpson, 2004; Kumar *et al*., 2007; Ben Ali *et al*., 2013; Elzomor *et al*., 2014; Rhangani *et al*., 2014). A study studies by Rubin *et al*. (2015), showed that bone pathological effects of tumors especially lytic tumors are higher than primary bone tumors.

Table 1: Various instrument employed in bone fracture management

Affected bone	Plaster of Paris	Pin and cerclage wires	Bone plates and screws	Reduce exercise	Combination of internal/ external fixation	Roberts Jone Bandage	Adhesive bandage	Euthanized & amputation	Total	%
Femur	4	27	6	5	0	0	0	5	47	30
Ulna & radius	19	0	15	3	4	5	0	0	46	29.3
Tibia & fibula	7	11	1	3	5	1	0	0	28	17.8
Humerus	0	0	4	3	4	0	0	0	11	7
Phalanges	6	0	0	0	0	1	4	0	11	7
Carpus	4	0	0	0	0	0	1	0	5	3.2
Metacarpus	2	1	0	0	0	0	2	0	5	3.2
Metatarsus	1	0	0	0	0	1	0	1	3	1.9
Tarsus	0	1	0	0	0	0	0	0	1	0.6
Total	43	40	26	14	13	8	7	6	157	
%	27.3	25.5	16.6	8.9	8.3	5.1	4.5	3.8		100

According to the current study findings, fractures of the hind-limbs were more frequently reported than fore-limbs which was similar to studies reported elsewhere (Ben Ali, 2013; Rhangani *et al*., 2014). However, this was contrary to the report by Fox, (1997), who reported higher cases of forelimb fractures than hind limb fractures.

Long bone fractures as per the current study had higher incidences of occurrence with radius, ulna and femur at 44%. These findings were consistent with those reported elsewhere (Harasen, 2003; Beale, 2004; Elzomor *et al*., 2014).

In terms of description of the type of fractures in various bones, the current studies revealed that classification of fractures by most of the practitioners was based on the direction of the fracture line and the number of fragments, hence, spiral/oblique fracture and transverse. This approach was consistent with the principles described elsewhere (Simpson, 2004; Shales, 2008; Shiju *et al*., 2010; Ayyappan *et al.*, 2011).

The treatment of bone fractures observed in the current study, type and anatomical location of fracture as per radiographic description influence the kind of intervention technique and instruments used in the management of the cases, (Perry and Bruce, 2016). Furthermore, the affected bone determines the technique and instruments employed to meet full functioning of the limb similar to research finding by (Ramirez and Macias, 2016).

The study findings indicated that confinement of affected dogs is common among mild fracture cases especially incomplete fractures as a way to minimize stress and further traumatizing of soft tissues and bone tissue. Similar results were reported by Perry and Bruce, (2016).

The common challenges encountered in bone fracture management included; non-compliance of the owner, non-union, mal-union, excessive callous tissue formations, dehiscence of intramedullary pin, lag screws and bone plates. Infection is the major challenge in management of fracture due to iatrogenic infection, haematogenous infection and other foreign agents within the environment. These observations confirm the need for clinicians to be vigilant in management of bone fractures to minimize complication similar to Rubin *et al.* (2015). Pelvic fractures are accompanied by nerve paralysis, massive bleeding and urinary and fecal incontinences thus management of the cases becomes difficult to undertake since other body systems are challenged like circulatory system due to hypovolemia, hence similar to research finding by Xie *et al.* (2016).

Conclusions

This study concluded that male dogs aged14 months and below, recorded a higher incidence of appendicular bone fractures. Medium breed dogs (6-10kgs) and breeds above 21kgs had the highest number of facture cases. Car accident and fallen from heights were the major causes of appendicular bone fractures. The incidence of long bone fractures (femur, radius, ulna, fibula, tibia and humerus) was higher as compared to fractures in the short bones (tarsus, carpus, metacarpus, metatarsus and phalanges).

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