PREVALENCE, CHARACTERISTICS, MANAGEMENT AND OUTCOMES OF WOUNDS AND SURGICAL PROCEDURES IN DOMESTIC CATS PRESENTED TO SELECTED VETERINARY CLINICS IN NAIROBI COUNTY, KENYA

A Thesis Submitted in Partial Fulfilment of the Requirements for the Award of the Degree of Master of Veterinary Surgery of the University of Nairobi

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DECLARATION

This thesis is my original work and has not been presented for award of a degree in any other university.

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To my daughter Nailah Oundo, Father Prof. Joe Oundo, Mother Valerie Oundo and my three brothers, Emmanuel Oundo, David Oundo and Jude Oundo.

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ABSTRACT

A retrospective study was conducted on clinical records of domestic cats presented to six Veterinary Clinics in Nairobi County, Kenya over a ten year period (2007 to 2016), with the objectives of determining 1) prevalence of wounds and other surgical procedures, 2) the characteristics of wounds and 3) the management and outcomes of wounds in these cats. The lack of current published data on cats in Kenya motivated the study. Data was collected by retrieving information from archived records using case record books and catalogues in these clinics. Case record information on cat breed, gender, age, neuter status, nutritional status, diagnosis, wound type, location, cause, culture and sensitivity, treatment and outcomes was collected and recorded. Data on other surgical conditions and procedures carried out on the cats was collected and recorded. The data was given numerical codes for ease of entering them into Microsoft Excel spread sheets. The data was imported into SPSS statistical software and into GenStat 64 bit release 13.3 copyright 2010 for analysis. Univariate and multivariate analysis was done to test for association between possible risk factors and outcomes as well as association with wound characteristics. Medical records involving 2,444 cases of domestic cats were retrieved from all the 6 veterinary clinics. Percentages of occurrence various parameters and factors in the case records were also calculated.

Among the cases retrieved from the six clinic records, injuries were in 9.9% (n=244) of which 61.9% (157) had soft tissue injuries, 13% (n=31) had fractures, 14.8% (n=36) had abscesses and each of the rest: laceration, puncture, avulsion, cellulitis, hematoma and bruise: were in less than 5%.

Surgical procedures were performed in 23.9% (n=585) of the cases. Of these, 34.4% (n=201) had ovariohysterectomy and 21.7% (n=127) had castration done, while the rest of the surgical procedures accounted for less than 5% each. Among the total population of cats whose records were studied, 13.9% (n=339) had surgical/wounds that involved the digestive system, 10.3% (n=251) the integumentary system and 6.1% (n=149) musculoskeletal system. The rest of the systems were involved in less than 5% each. Out of the 244 cases with wounds, 14.8% (n=36) were caused by unspecified traumas, 13.6% (n=32) were from fights, 8.2% (n=20) were surgical wounds, 7% (n=18) were from bites, 0.4% (n=1) were from burns, and in 56% (n=136) had records with no indication of the causes of the wounds. The cases with wounds involved various body regions; 43.4% (n=106) on the limbs, 16.8% (n=41) affected the facial region, 9.8% (n=24) affected the abdominal region, 7.8% (n=19) and 7.4% (n=18) affected the neck and pelvic regions respectively. Exudates/discharges were present in wounds in 30.3% (n=74) of the cases, infection in 38.5% (n=94) and necrosis in only 2.1% (n=5) of the cases. Presence and degree of pain was recorded in 57.4% (n=140) of the cats with wounds, but no records were entered in 42.6% (n=104) of cases. Systemic antibiotics were recorded as used to treat wounds in 39.3% (n=96) of the cases and topical forms of treatments in 18.5% (n=45), while others such as anti-inflammatory agents, hot fomentation and honey were used in less than 5% each. Some of the surgical procedures used to manage wounds in the cats included stitching in 16.0% (n=39), orthopaedic procedures in 6.6% (n=16) and others including lancing, amputation, reconstructive surgeries, bandaging and herniorrhaphy in less than 5% each. The outcomes of cats with wounds included 43.0% (n=105) recoveries, 3.3% (n=8) recurrences, 2.5% (n=6) euthanized and 1.6% (n=4) deaths. In contrast, 49.6% (n=121) of the cases had no indication of the outcomes in their records.

There was twice the likelihood of signs of pain in cases that had infected wounds compared to those without infection (p=0.047, OR=2.19). There was approximately 4 times likelihood of wound occurrence in soft tissues compared to other tissues (p=0.026, OR=3.7). For every category of parameters evaluated from the case records, majority of the cases lacked recorded details. It is concluded from the study that the prevalence of injuries was generally low but relatively higher in soft tissues than other tissues. A higher percentage of the wounds had infections with presence of exudates. The main wound management method was by use of systemic antibiotics, supported occasionally by topical application of antimicrobial agents. With treatment, wound healing and recovery of the domestic cats presented with wounds was averagely high. A prospective study on health conditions of domestic cats in the homes would give more accurate data on whether cats are well taken care of. Record keeping should be improved with inclusion of all relevant case details.

CHAPTER ONE

1.0 INTRODUCTION AND OBJECTIVES

1.1 INTRODUCTION

Cats of the genus Felis have had increased universal acceptance even in Muslim community, which does not keep dogs owing to religious convictions. The current world population of cats is higher than that of dogs at 94.2 million and 89.7 million respectively (Springer and Julie, 2017). Despite their high population, information on their veterinary care is scanty (Brown *et al*., 2007). This has partly been attributed to the belief by most owners that cats rarely need medical attention and that they have low likelihood of infections (Lue *et al*., 2008). Nevertheless, few cats are still presented to veterinary clinics with various medical and surgical conditions.

Majority of cases of cats presented to veterinary clinics in the United States have had dental conditions. The most common dental conditions reported were dental caries, erosions and feline odontoblastic resorptive lesions. This involves the destruction of odontoclasts on the cemental or external tooth surface. Domestic cats have also been presented to veterinary clinics for routine elective surgical procedures, fractures, soft tissue wounds (Alexander *et al*., 2002).

A wound is defined as breakage in continuity of body tissues such as skin or any other body structure (Fossum, 2018). Wounds are a result of either mechanical or chemical injury. Wounds should be carefully examined and classified to aid in the choice of appropriate management approaches. Wounds can be classified as open or closed, and further according to degree of contamination and causative agents. The choice of wound management is influenced by various factors such as type of wound, nature of exudates, extent of infection, duration of the wound, location, and dimensions of the

wound, presence of foreign bodies and extent of tissue damage. It is also influenced by the animal factors such as species, age, and concurrent nutritional and medical status. Other critical factors essential to consider in examining wounds in a patient include hemostasis, neurovascular supply and extent of musculoskeletal involvement (Fossum, 2018, Mickelson and Mans Colopy 2016, Orsted, 2004, Kerstein, 1997).

Wound healing and repair are achieved through biological and biochemical processes that are characterized under four phases, which include: hemostasis, inflammation, proliferation/granulation and remodeling/maturation. These phases overlap and the duration for each phase depends on the type of wound and management principles employed (Fossum, 2018, Kozar, *et al.,* 2018, Orsted, 2004, Kerstein, 1997). In a normal patient, the hemostatic cascade takes place within minutes. It involves the release of blood clotting factors to form a fibrin mesh over the wound with the aid of platelets. Inflammation involves mobilizing neutrophils for initial defense against pathogens. This hastens the wound healing process. Proliferation of fibroblasts and collagen occurs simultaneously with inflammation to strengthen the framework created by the fibroblasts during the hemostatic stage. The last step of wound healing involves remodeling of the collagen tissue to strengthen and realign the wound (Kožár, *et al.,* 2018).

A study conducted in United States of America describing the patterns of injuries in domestic cats reported a 13% incidence of wounds. The incidence was higher in cats than in dogs at 9%, which was attributed to less muscle cover in cats, thus inability to dissipate the impact from blunt force (Slatter, 1993). Information on the prevalence, etiology and pattern of injuries affecting dogs and cats in developing countries including Kenya is scant. To establish the feasibility and justification of the project, a preliminary study reviewed medical records of 343 patients from two veterinary clinics in Kenya in 2015. The results

revealed that the most frequent reason for presenting domestic cats to the clinics were soft tissue wounds (58.3%; n=200) and elective surgical procedures particularly neutering [castration (17.5%; n=60) and ovariohysterectomy (14.6%; n=51)], and medical conditions (9.3%; n=32). Wounds were sustained from fights, trauma by other causes, or surgery. No previous studies had been reported on the prevalence of soft tissue injuries in domestic cats in Kenya, prompting the design of the current study.

1.2 HYPOTHESIS

Global evidence for soft tissue injuries in domestic cats is being widely reported. However, empirical evidence in scientific publications describing the prevalence, etiology, types, management, and outcomes of wounds as well as surgical conditions in domestic cats in Kenya is scant. It was therefore necessary to determine the prevalence of soft tissue injuries and surgical procedures in domestic cats presented to veterinary clinics in the urban and peri-urban areas of Nairobi County, Kenya.

The study was designed with the hypothesis that the prevalence of soft tissue injuries and surgical procedures carried out in domestic cats in, Kenya, is moderately high.

1.3 GENERAL AND SPECIFIC OBJECTIVES

1.3.1 GENERAL OBJECTIVE

To determine the prevalence, clinical characteristics, management and outcomes of wounds and other surgical procedures in domestic cats in selected veterinary clinics in Nairobi County, Kenya.

1.3.2 SPECIFIC OBJECTIVES

The specific objectives of the study were:

i. To determine the prevalence of soft tissue injuries and other surgical procedures in domestic cats presented to selected veterinary clinics in Nairobi County, Kenya from January 2007 to December 2016.

ii. To determine the characteristics of wounds that occurred in domestic cats presented to selected veterinary clinics in Nairobi County, Kenya from January 2007 to December 2016.

iii. To determine the management and outcomes of wounds in domestic cat presented to selected veterinary clinics in Nairobi County, Kenya from January 2007 to December 2016.

1.3.3 JUSTIFICATION

The global population of domestic cats has been increasing and was estimated at 94.2 million (Springer and Julie, 2017). The number of domestic cats being admitted to the veterinary clinics for various surgical conditions is increasing, but still lower than that of dogs attended in veterinary clinics for surgical conditions (Amy *et al*., 2010). There is no available scientific documentation on the prevalence of wounds and surgical procedures in domestic cats in Kenya. It was therefore hypothesized that the prevalence of wounds and surgical procedures carried out in veterinary clinics in Kenya on domestic cats is high. This prompted the design and implementation of the study to determine the actual status of wounds and surgical procedures for the 10-year period included in the study.

There is a demand for additional research in domestic cats, especially evidence-based health care (Amy *et al.,* 2010). Preliminary review of the records in three veterinary clinics before the full study, revealed that most domestic cats presented to these clinics were mainly for elective surgical procedures such as castration and ovariohysterectomy. There is no documented account of the prevalence and type of wounds as well as surgical procedures carried out in domestic cats in Kenya. Therefore, this study aimed at

determining the prevalence, characteristics, management and outcomes of soft tissue injuries as well as the surgical procedures in domestic cats presented to the veterinary clinics in Nairobi County, Kenya.

CHAPTER TWO

2.0 LITERATURE REVIEW

2.1 ANATOMY OF THE FELINE SKIN

The skin is the first barrier offering protection from pathogens such as bacteria, fungus and viruses (Foss *et al.*, 2008). The skin of a cat has two major layers: the epidermis and the dermis (Figure 2.1). The epidermis is further sub-divided into five other layers; stratum basale, stratum spinosum, stratum granulosum, stratum lucidum and stratum corneum. The epidermis, dermis and subcutaneous tissue of the domestic cat is significantly thinner than that of the dog, and more pliable and mobile over most body Surfaces (Langley-Hobbs *et al.*, 2013).

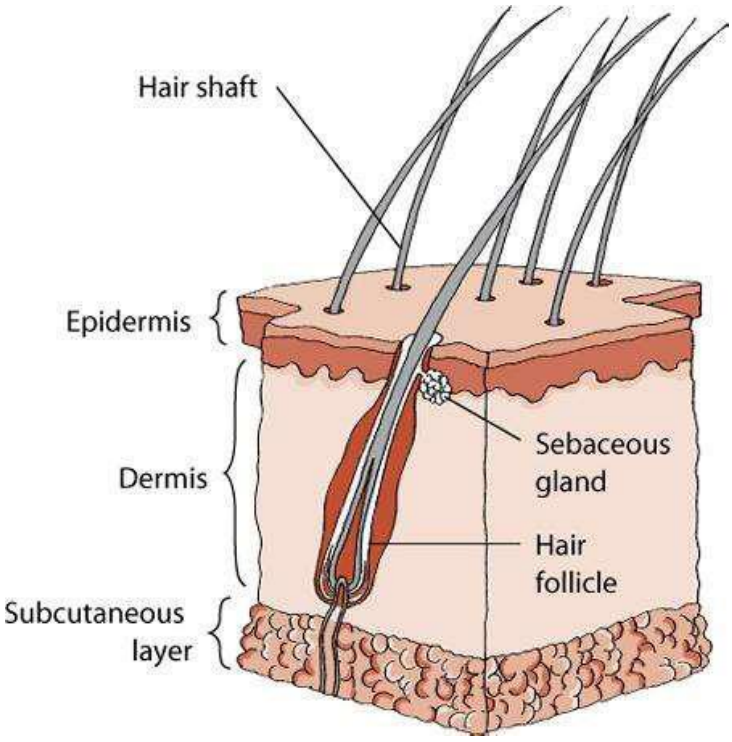


Figure 2.1: **The anatomical structure of the Feline skin (Adapted from https://www.msdvetmanual.com/cat-owners/skin-disorders-of-cats/structure-of-the-skin-in-cats). Visited on 25.05.2020 at 1920hrs.**

2.2 SURGICAL AND TRAUMATIC WOUNDS IN CATS

Unlike other domestic animals, the domestic cat offers little to human survival. Many people have a strong belief that cats get sick less frequently in comparison to other

animals. This may be attributed to erroneous beliefs that cats are self-sustaining and that detecting disease in cats is rather difficult (Amy *et al.*, 2010). This probably explains the low cat patients in veterinary clinics around the world compared to dogs. Wounds in domestic cats are managed slightly different from those in dogs, which can be attributed to the nature of the loose subcutaneous tissue in cats (Murgia, 2016).

2.2.1 SURGICAL WOUNDS

A wound is defined as the breakage in continuity of body tissues such as skin or any other body structure (Fossum, 2007). Surgical wounds are a result of surgical procedures that have been performed. Surgical site infections that occur after surgery may lead to delayed wound healing (Nelson, 2011). The most common elective surgical procedures carried out in domestic cats are neutering i.e. ovariohysterectomy and castration. Wounds created from surgical procedures are considered as clean wounds under aseptic techniques (Altmeier *et al*., 1976).

2.2.2 TRAUMATIC WOUNDS

Orthopedic cases in cats include fractures which occur mostly through trauma from motor vehicle accidents and dog bites. Majority of cases reported with fractures involve the femur and least affected is the humerus (Catarina *et al*., 2016). Tarsal injuries have also been reported as common especially in male cats. These result from motor accidents. These injuries are corrected surgically with the most common complication being necrosis of the skin. Large wound defects have been reported to result in dogs because of damage to the metatarsal artery during the initial injury. This has not been reported in cats (Kulendra and Arthurs, 2014).

2.3 CLASSIFICATION AND CHARACTERISTICS OF WOUNDS

Wounds can be classified and categorized based on the following criteria: according to the causative agent (venom, thermal burns, chemicals, mechanical injury, and radiation) and bacterial contamination (clean, clean contaminated, contaminated, and heavily

contaminated) (Fossum, 2007). Wounds can also be classified as open or closed wounds depending on whether there is full thickness (open) or partial breakage (closed) of the skin, respectively. The characteristics of wounds that should be evaluated for appropriate management include: type and location of the wound, whether open or closed with respect to skin breakage, stage of the wound, size of wound, whether infected or not, presence and amount of exudates, presence of odor, state of the surrounding tissues (color and appearance), level of pain. Surgical wounds can be classified into the following categories based on their degree of contamination (Fossum, 2007).

Clean wound – this is whereby a surgical procedure is performed without breaking any asepsis and not entering the main three systems that are open to the environment: gastrointestinal tract, respiratory system and the urogenital system.

Clean contaminated wounds – is whereby there is a slight break in asepsis and includes elective procedures into the three main systems that are open to the environment with minimal leakage.

Contaminated wounds – this is whereby there is a major break in asepsis with significant leakage from the three systems and in the presence of infection.

Dirty wound – this includes the gross contamination of the surgical site, and presence of a foreign material and purulent inflammation. Necrotic tissue may also be available in the wound.

Traumatic wounds can be classified into three main categories based on the duration before they are presented for management and include: (Fossum, 2007)

Class 1 – these classes of wounds are presented during the golden hours, usually 0 – 6 hours after the injury has occurred with minimal tissue contamination.

Class 2 – these are presented after 6 hours and not before 12 hours with degree of infection but not to its critical extent.

Class 3 – these are presented more than 12 hours after injury with gross wound infection.

The characteristics of wounds based on various classifications are presented as described by Langley-Hobbs *et al.* (2013) in Table 1.

Table 1. 1: Types of wounds under various classifications

Type of wound	Characteristics
Shear	Skin loss with underlying tissue loss. Usually heavily Contaminated
Avulsion	Skin and tissue loss with little underlying tissue loss. Skin may lie back down onto the underlying tissues and initially appear normal despite devascularization
Degloving	Skin loss at the extremities resulting in a circumferential deficit. This is problematic as it cannot contract to heal by second Intention
Puncture wound	Caused by sharp pointed object e.g. bite wounds. Potentially having deep seated infection and abscess.
Ballistic	The damage caused is dependent on the speed and distance of the missile or bullet with risk of organ injury.
Crush injury	There may be little damage on the skin surface, but underlying organ and muscle damage may be difficult to determine at initial examination.
Abrasion	These are friction-caused wounds with partial thickness injury with dermal retention, but denuded epidermis. May cause significant fluid loss if large areas affected. Can be extremely painful due to injury of sensory nerve endings on cutaneous tissue.
Laceration	Skin wound with little lateral trauma from the wound. Variable depth, generally little associated tissue damage due to irregular margins caused by tissue tear.
Heat/chemical Burns	The extent of the damage may not be apparent for several days until the skin necrosis is complete
Skin sloughing secondary to necrosis or Vasculitis	Skin slough caused by vasculitis may be associated with systemic disorders such as coagulopathy, hypotension, pyrexia, etc. Skin loss depends on type of bite and mechanism of actions.
Fistula/sinus/foreign body tracts	Cat bites into the perineal area can cause sinus formation due to penetration of the rectum by sequestrate or bullet fragments may result in healing sinus tracts
Pressure sore/ secondary to skin Ulceration	Skin loss and ulceration can occur
Frostbite/	

thinning and poor repair secondary to especially the Sunburn	hyperadrenocorticism Cats may suffer skin loss of extremities, pinnae when exposed to extreme weather
Iatrogenic	
Surgical wound Dehiscence	Wound dehiscence usually occurs secondary to tension, poor suture technique, infection, and self-trauma or poor vascularization of the skin edges.
Tourniquet Injuries	Improper bandage application may also result in skin loss due to a tourniquet effect on the limb

2.4 WOUND MANAGEMENT AND OUTCOME

Management of a wound is influenced by its type and characteristics. Other factors that may influence the method of wound management include; time lapse from when the wound is presented for management, extent of damage to the tissue, amount of tissue loss, level of contamination, patient health status, blood supply to the area affected, and location of the wound (Murgia, 2016).

2.4.1 WOUND PREPARATION AND CLEANSING

Wounds should be assessed together with the overall health status of the animal before management protocol is started. Temperature, heart rate, respiratory rate, level of shock should all be assessed prior. This aids to judge the severity of the wound and if it is life threatening. Wounds need to be prepared aseptically before treatment can be employed. This is done by shaving (clipping) the area around the wound and washing using water and chlorhexidine. The wound should be irrigated with copious amount of water to rid the wound off gross contamination and reduce on the debris. The best solution to use for wound irrigation is normal saline 0.9%, Hartmann's solution, or normal tap water. Different chemicals can be used to reduce the necrotic debris and bacterial contamination: commercial cleansers, tap water, balanced electrolyte solution, normal saline (0.9%) solution, Tris EDTA, 0.1% Povidone iodine, and 0.05%chlorhexidine solution (Fossum, 2018). The wound should be covered in a dressing or bandaged until the patient is stabilized before any treatment plan can be instilled. This is done for patients who are compromised with significant blood loss. Proper wound management requires the patient to be sedated or put under general anesthesia to accurately assess the wound and form a definitive plan but should be done only after the patient has been stabilized (Murgia, 2016).

2.4.2 SURGICAL TREATMENT

Primary healing can be instilled by using simple suture techniques in fresh wounds that have not been contaminated. Surgical procedures that are used for cosmetic wound correction are: local flaps, axial pattern flaps, and free skin grafts for large defects in cooperated together with plasma rich platelets for a better outcome (Marudhamuthu *et al., 2016,* Doyle, 2012). Wounds that are presented more than 12 hours after occurrence are left to heal using secondary intention after wound preparation has been carried out (Fossum, 2018).

2.4.3 CONSERVATIVE MANAGEMENT

Topical antibiotics, manuka honey and sugar have been employed to treat wounds (Mathews *et al.,* 2002). Initial antibiotics use is recommended for chronic wounds which are mostly polymicrobic, though after culture and sensitivity is done to reduce on the effects of drug resistance. It is recommended to stop antimicrobial drugs once healthy granulation tissue starts to form as there is little penetration of the drug to the target site. Silver sulfadiazine may be used as a topical antibiotic in some wounds. Antibiotics are routinely used in most wound to prevent infection as it can delay wound healing (Murgia, 2016).

Sugar has been employed in wound healing and its main effects are on granulation tissue formation and epithelialization of the wound. It can be applied on the wound and a bandage dressing applied to cover it. The dressing should be changed twice or thrice a day since sugar encourages greater effusion to the wound (Murgia, 2016).

Honey has been used because of its effect in reducing inflammation, antibacterial, angiogenesis, immunostimulatory effect, and leukocytes production through cytokine stimulation for growth of cells, release of tumor necrosis factors alpha, edema, effect on granulation tissue formation and epithelialization and dehydrating pathogens. Despite its

effects on wound healing, honey is still slowly being accepted by veterinarians. It aids in epithelialization through the production of keratinocytes growth factors and fibroblast growth factor 7 (Eyafere and Oguntoye, 2016). The different brands used include Medi honey, Surgi-honey, Manuka honey and Activion tube.

Vacuum assisted wound closure is another method of wound management. This has been employed in human medicine and slowly being introduced into veterinary medicine. It aids in wound healing by promoting early granulation bed formation and improving circulation. It is commonly used in large wound defects and non-healing wounds (Kirkby *et al.,* 2010). Avulsion, de-gloving, and shearing wounds have to be managed medically in-order to create new tissue before surgical intervention is attempted (Fossum, 2018). With proper and appropriate initial management and care, such wounds may have favorable prognosis. Depending on the extent of injury, splints, implants, and proper dressing may be required for wound management.

Management of surgical site nosocomial infected wounds is through culture and sensitivity to isolate the causative organism and use the antimicrobial of choice. Delicate wound care, debridement and open wound management leads to more favorable prognosis (Nelson, 2011).

CHAPTER THREE

3.0 MATERIALS AND METHODS

3.1 STUDY DESIGN

A retrospective study involving retrieval of domestic cat data from records kept by veterinary clinics was used. These were records of domestic cats presented to the Small Animal Clinic, University of Nairobi and five other designated veterinary clinics, with soft tissue wounds or for surgical procedures from January 2007 to December 2016. The clinics were designated as CLINIC 1, CLINIC 2, CLINIC 3, CLINIC 5, CLINIC 6, and CLINIC 7.

3.2 STUDY AREA

Nairobi County is the city county of the Republic of Kenya. It has an approximate population of 3.1 million people. The metropolitan area extends to the neighboring counties of Kiambu, Machakos and Kajiado (Figure 2.2 and 2.3). The study was carried out in the Small Animal Clinic, Faculty of Veterinary Medicine, University of Nairobi and 5 other designated private veterinary clinics in Nairobi County.

Figure 3. 1: **The map of Kenya showing location of Nairobi county.**

(https://geology.com/world/kenya-satellite-image.shtml). Visited on 22.09.2020 at 10.05

Figure 3. 2: **Map of Nairobi County and surrounding counties (https:** //gadgets-

africa.com/2020/04/06/breaking-frst-case-of-coronavirus-confrmed-in-kenya/). Visited on

22.09.2020 at 10:12

3.2.1 OVERALL DATA COLLECTION

The general critical data was from records of domestic cats presented to all the 6 veterinary clinics from January 2007 to December 2016. The specific case records of main interest were those of domestic cats that had been presented with soft tissue wounds/injuries as well as those of cats that had undergone surgical procedures other than for wounds.

All case records of domestic cats in the university small animal clinic and the 5 designated clinics were retrieved from the clinic archives using the clinic master catalogues for each year. From these records, all the record cards for the domestic cats that were presented with soft tissue wounds as well as all those that had undergone surgical procedures were set isolated. Each of these isolated cards was closely scrutinized for details on the types of wounds, characteristics of wounds, treatment/management and outcomes and recorded in the data collection sheets. Details of types of surgeries performed on the cats were also scrutinized and recorded in the data collection sheets.

3.2.2 DATA COLLECTION ON SURGICAL PROCEDURES

Important data collected for each type of surgery included: case number, date, year, breed, age, sex, type of surgery, tissue/location involved, cause, clinical manifestation, weight, nutritional status, and other specified surgical procedures. These data were recorded in data collection sheets (Appendix 1).

3.2.3 DATA COLLECTION ON WOUND TYPES AND CHARACTERISTICS

The following characteristics of wounds were scrutinized from each case record of cats with soft tissue wounds: type and size of wound, presence of necrotic tissue, tissue loss, presence of infection, isolated bacteria, presence and type of exudate and odor. The data was recorded in data collection sheets (Appendix 2).

3.2.4 DATA COLLECTION ON WOUND TREATMENT/MANAGEMENT AND OUTCOMES

The different methods employed for treatment/management of the various wounds were noted from the individual records. This included: shaving/clipping of hair, wound cleaning/lavage, debridement, surgical interventions, wound closure, bandaging, topical treatment, hot fomentation, use of analgesia and use of anti-inflammatory drugs. Samples collected for laboratory analysis and culture. The various outcomes that ensued were noted, which included: complete healing, non-healing, complications, duration of healing and death of the cat. These data were recorded in the data collection sheets (Appendix 3).

3.3 DATA MANAGEMENT AND ANALYSIS

The parameters of the data collected were coded for ease of entry into Microsoft Excel 2019 16.0.6742.2048 sheet. The data was cleaned, verified, and validated as correct entries as per the data collection sheets. The data was imported to GenStat 64-bit Release 13.3 (PC/Windows 7) 02 February 2012 Copyright 2010, VSN International Ltd for analysis.

3.3.1 DESCRIPTIVE STATISTICS

Descriptive statistics was computed using the demographics of all the domestic cat cases and the occurrences of wounds and the surgical procedures. This included the number cases per category of wounds, their factors, management, and outcomes as well as and surgical procedures and their related factors. Descriptive statistics also took into account the breed, age and sex of cats as well as the occurrences for each specific designated veterinary clinic.

3.3.2 Calculation of overall prevalence of surgical cases

Overall prevalence of surgical cases (without including wounds) was calculated as the total number of surgical cases (TC-Surgery) divided by the total number of domestic cat cases multiplied by 100 and expressed in percentage.

$$\textit{Overall Prevalence of Surgical Cases} = \frac{\textit{TC-Surgery}}{\textit{Total Number of Cases}} \text{ X } 100$$

3.3.3 Calculation of prevalence of each type of surgery performed

Prevalence of each type of surgery performed was calculated as the total number of cases with each specific type of surgery (TC-Surgery Type) divided by the total number of cases in which surgery was performed multiplied by 100 and expressed as a percentage:

$$\textit{Case Prevalence for Each Surgery Type} = \frac{\textit{TC-Surgery Type}}{\textit{Total Surgery Cases}} \text{ X } 100$$

3.3.4 Calculation of overall prevalence of soft tissue wounds

Overall prevalence of soft tissue wounds was calculated as the total number of cases with soft tissue wounds (SFT-Wounds) divided by the total number of domestic cat cases (TN-Cases) multiplied by 100 and expressed as percentage.

$$\textit{Overall Prevalence of Soft Tissue Wounds} = \frac{\textit{SFT-Wounds}}{\textit{Total Number of Cases}} \text{ X } 100$$

3.3.5 Calculation of prevalence of each type of wound

The prevalence of each type of wound was calculated as the total number of cases with each type of wound (T-Wound Type) divided by the total number of cases with wounds multiplied by 100 and expressed as percentage.

$$\textit{Prevalence of Each Type of Wound} = \frac{\textit{T-Wound Type}}{\textit{Total Number of Wound Cases}} \text{ X } 100$$

3.3.6 Calculation of percentage occurrence for each wound characteristic

The percentage occurrence of each characteristic of wounds was calculated as the total number of cases with the specific wound characteristic (TC-Specific Characteristic) divided by the total number of cases with wounds multiplied by 100 as follows:

$$\textit{Percentage of Each Wound Characteristic} = \frac{\textit{TC-Specific Characteristic}}{\textit{Total Number of Wound Cases}} \times 100$$

3.3.7 Calculation of percentage of wound cases per management protocol Percentage of cases whose wounds were treated with specific management protocol was calculated as the total number of cases managed with each specific protocol/substance (TC-Specific Protocol) divided by the total number of wound cases managed multiplied by 100 as follows:

$$\textit{Percentage of each Management Protocol} = \frac{\textit{TC-Specific Protocol}}{\textit{Total Cases of managed wounds}} \times 100$$

3.3.8 Calculation of percentage of cases with each specific outcome

Percentage of cases with each specific outcome was calculated as the total number of cases with each specific outcome (TC-Specific Outcome) divided by the total number of cases with wounds multiplied by 100 as follows:

$$\textit{Percentage for Each Specific Outcome} = \frac{\textit{TC-Specific Outcome}}{\textit{Total Wound Cases}} \times 100$$

3.3.9 Association test statistics

Simple univariate analysis was done using Chi Square statistics to test for association between each of the following factors: type of wound, wound characteristics and wound management protocol against wound outcome at $P < 0.05$ significance level. Each

management protocol (variables) as well as each major wound characteristic (variables) were evaluated against the wound outcomes. The Chi Square was determined using 2 x 2 contingency tables consisting of 2 rows and 2 columns. The factors that revealed significant association from the univariate analysis, were subjected to multivariate analysis in order to identify the most probable factors that influenced wound outcomes but maintaining statistical significance at $p < 0.05$.

CHAPTER FOUR

4.0 RESULTS

4.1 DESCRIPTIVE STATISTICS

The total number of cats presented to the veterinary clinics included in the study for the ten-year period is 2,444 of which 35% (n = 870) were female, 32% (n = 788) were male and 33% (n = 786) had no gender specifications specified in the records. Out of the total cats presented, 18.98% (n = 464) of the females were entire, 8.8% (n = 215) were neutered, and 7.82% (n = 191) were not specified whether entire or neutered. Out of the total cats presented, 16.86% (n = 412) of the males were entire, 8.14% (n = 199) were neutered, and 7.24% (n = 177) were not specified whether entire or neutered (Table 4.1).

The prevalence of domestic cat cases presented to the veterinary clinics in Nairobi County increased steadily over the years with the highest prevalence recorded in 2016 at 26.0% (n=635) and the lowest in 2007 at 2.73% (n=67). The annual prevalence of cases of domestic cats presented to the veterinary clinics for the ten years is presented in Table 4.2.

Cats below one year of age were 27.0% (n = 661) of the domestic cats presented to the clinic. The prevalence decreased gradually to 0.04% (n=1) for those 15 – 16 years of age. Age was not recorded in 41.74% (n = 1020) of the cats (Table 4.3).

Table 4. 1: **Percentages of neutered and unneutered domestic cats presented to the veterinary clinics in Nairobi County, Kenya from January 2007 to December 2016.**

Gender	**Number**	**Percentage**
Female	870	35.59
Entire	464	18.98
Neutered	215	8.80
Unspecified	191	7.82
Male	788	32.25
Entire	412	16
Neutered	199	8.14
Unspecified	177	7.24
Total unspecified	786	32.16
Total	2444	100

Table 4. 2: **Annual prevalence of domestic cats presented to the Veterinary Clinics in Nairobi County, Kenya from January 2007 to December 2016.**

YEAR	NUMBER	PERCENTAGE
2007	67	2.73
2008	136	5.50
2009	144	5.90
2010	201	8.23
2011	183	7.49
2012	213	8.72
2013	240	9.83
2014	265	10.85
2015	360	14.75
2016	635	26.00
TOTAL	2444	100

Table 4. 3: **Percentage of age categories of domestic Cats presented to the veterinary clinics in Nairobi County, Kenya from January 2007 to December 2016.**

Age category in years	Number	Percentage
< 1	661	27.05
1-2	165	6.75
2-3	126	5.16
3-4	100	4.09
4-5	87	3.56
5-6	66	2.70
6-7	36	1.47
7-8	40	1.64
8-9	34	1.39
9-10	34	1.39
10-11	24	0.98
11-12	16	0.65
12-13	8	0.33
13-14	14	0.57
14-15	10	0.41
15-16	1	0.04
16-17	2	0.08
Unspecified	1020	41.74
Total	2444	100

The highest breed prevalence of domestic cats presented to the veterinary clinic in the ten-year period evaluated was domestic short hair at 80.7% (n=1973). Other breeds had prevalence of less than 5% including cross breeds at 4.1% (n=99) as indicated in Table 4.4. A total of 5.9% (n=145) had no breed specified in the case records.

Table 4. 4: Prevalence of the various breeds of domestic cats presented to the veterinary clinics in Nairobi County, Kenya from January 2007 to December 2016.

Breed	Number	Percentage
Domestic short hair	1973	80.7
Unspecified	145	5.9
Cross	99	4.1
Domestic long hair	78	3.2
Persian	53	2.2
Siamese	28	1.1
Local	13	0.5
Chartreux	8	0.3
Sokoke	6	0.2
Burmese	5	0.2
Tabby	5	0.2
Russian blue cross	4	0.2
Egyptian mau	3	0.1
Tuxedo	3	0.1
Bengal	2	0.1
British short hair	2	0.1
Ginger	2	0.1
Himalayan	2	0.1
Norwegian	2	0.1
Tortoise shell	2	0.1
European	1	0.04
Kalf	1	0.04
Oriental short hair	1	0.04
Ragdull	1	0.04
Tommy	1	0.04
Tortoise shell white	1	0.04
Turkish	1	0.04
Total	2444	100

4.2 WOUNDS AND SURGICAL PROCEDURES

Among the 2,444 cases of domestic cats presented to the six veterinary clinics, 87.64% (n=2142) had no wounds but had other conditions, and 12.36% (n = 302) had different types of wounds. Among the cases with wounds, soft tissue wounds had a prevalence of 51.99% (n = 157), fractures (closed and open) were 18.21% (n=55), with abscesses 9.93% (n=30), and others whose diagnoses were non-specified but still classified as wounds were 6.99% (n = 21). The rest of the conditions were less than 1% each (Table 4.5).

Case records for 23% (n = 585) of domestic cats presented to the veterinary clinics underwent different surgical procedures. Ovariohysterectomy was carried out in 34.36% (n = 201), castration in 21.71% (n = 127), and other surgical procedures for different condition was 31.12% (n = 182) as in Table 4.6. Fractures and wounds 39.13% (n = 27) had the highest prevalence of the conditions that resulted to surgery being carried out. (Table 4.7).

Table 4. 5: **Prevalence of external and internal soft tissue injury cases of domestic cats presented to the six veterinary clinics in Nairobi County, Kenya from January 2007 to December 2016.**

Soft Tissue Injuries	Number	Prevalence
Wounds	157	51.99
Fracture	55	18.21
Abscess	30	9.93
Others	21	6.99
Eczema	5	1.66
Nerve damage	4	1.32
Cancer	4	1.32
Dislocation	4	1.32
Sprain	4	1.32
Cellulitis	3	0.99
Myositis	3	0.99
Stomach ulcers	1	0.49
Proptosis	1	0.49
Corneal ulcer	1	0.49
Alopecia	1	0.49
Oral ulcer	1	0.49
Hip dysplasia	1	0.49
Loose nail	1	0.49
Luxation	1	0.49
Total	**298**	**100**

Table 4. 6: Prevalence of surgical procedures carried out in domestic cats presented to the six veterinary clinics in Nairobi County, Kenya from January 2007 to December 2016.

Surgical procedure	Number	Percentage (%)
Ovariohysterectomy	201	34.36
Others	182	31.12
Castration	127	21.71
Dental Scaling	45	7.69
Lancing	7	1.20
Amputation	6	1.03
Dental extraction	5	0.85
Eye enucleation	3	0.51
Bandage	1	0.17
Cast	1	0.17
Urinary catheterization	1	0.17
Cystotomy	1	0.17
Wound dressing	1	0.17
Gastrotomy	1	0.17
Grafting	1	0.17
Lavage	1	0.17
Tarsorrhaphy	1	0.17
Total	**585**	**100**

Table 4. 7: Prevalence of conditions that resulted to surgery, carried out in domestic cats presented to the six veterinary clinics in Nairobi County, Kenya from January 2007 to December 2016.

Surgical procedures	Number	Percentage
Fractures	27	39.13
Wounds	27	39.13
Cancer	2	3.02
Hematoma	1	1.44
Hernia	1	1.44
Polyp	1	1.44
Loose claw	1	1.44
Proptosis	1	1.44
Ruptured tendon	1	1.44
Urinary stones	1	1.44
Femoral head dislocation	1	1.44
Eye ulcer	1	1.44
Femoral head dislocation	1	1.44
Desmetocoele	1	1.44
Coxofemoral luxation	1	1.44
Cranial cruciate ligament rupture	1	1.44
Total	69	100

4.2.1 CLINICAL SIGNS RECORDED FOR CATS PRESENTED TO THE VETERINARY CLINICS

Case records for 64.4% (n=1576) of the domestic cats presented to the veterinary clinics had no information on reasons for being taken to the clinic. Based on the clinical signs, the most frequently affected systems were the alimentary system in 13.8% (n = 339) of the cases, integumentary system in 10.3% (n = 251) and musculoskeletal system in 7.7% (n = 186). Others with frequencies of less than 5% are presented in Table 4.8.

Table 4. 8: **Prevalence of clinical signs/systems affected in domestic cats presented to the six veterinary clinics in Nairobi County, Kenya from January 2007 to December 2016.**

Presentation/system affected	Number	Percentage (%)
Not indicated	1576	64.4
Alimentary	339	13.8
Integumentary	251	10.3
Musculoskeletal	186	7.7
Nervous	48	2.0
Urogenital	34	1.4
Cardiovascular	10	0.4
Total	2444	100

4.2.2 DIAGNOSES MADE BY THE VETERINARIANS IN THE CATS PRESENTED TO THE VETERINARY CLINICS

Among the domestic cat cases presented to the veterinary clinics, 62.7% (n=1523) had no definite diagnosis indicated in the case records. Some among them were presented for routine procedures such as deworming, vaccinations, castration and ovariohysterectomy. Hemo-parasite cases which included Babesia, Ehrlichia, Hemoplasma and Hemobartonella had a prevalence of 8.0% (n = 195). Based on diagnoses, integumentary system had highest prevalence at 10.8% (n = 264). This was followed by cardiovascular system at 10.1% (n = 248), and alimentary system conditions at 7.2% (n = 175). The rest of the body conditions had prevalence less than 5% each as shown in Table 4.9.

Table 4. 9: Percentages of diagnoses indicated in the case records for the domestic cats presented to the six veterinary clinics in Nairobi County, Kenya from January 2007 to December 2016.

Diagnosis according to system affected	Number	Percentage
Not indicated	1523	62.7
Integumentary	264	10.8
Cardiovascular	248	10.0
Alimentary	178	7.2
Musculoskeletal	95	3.8
Urogenital	37	1.5
Endocrine	33	1.4
Pulmonary	29	1.1
Nervous	25	1.0
Miscellaneous	12	0.5
Total	2444	100

The case records of the six veterinary clinics indicates that the cases of domestic cats that were presented during the ten-year period received various categories of treatments and agents as well as different procedures done to manage the conditions that the cats suffered or were required to undergo. These included routine vaccinations in 38.6% (n=944), various surgical procedures in 20.0% (n=489), antiparasitic agents in 13.7% (n=334), antibacterial agents in 10.1% (n=246) and nutrient, mineral or electrolyte supplements in 5.16% (n=125). The rest of the treatments and management that were each less than 5% are presented in Table 4.10.

Table 4. 10: **Prevalence of various categories of treatments and procedures done or agents given to manage cases of domestic cats presented to the six veterinary clinics in Nairobi County, Kenya for the ten-year period from January 2007 to December 2016.**

Treatment/management procedures	**Number**	**Prevalence (%)**
Routine Vaccinations	944	38.6
Surgical procedures	489	20.0
Antiparasitic agent	334	13.7
Antibacterial agent	246	10.1
Nutrients, Minerals, Electrolytes	125	5.16
Gastrointestinal tract agent	100	4.0
Antifungal agent	50	2.0
Anti-inflammatory agent	46	1.9
Euthanasia	44	1.8
Ophthalmic agents	35	1.5
Analgesics	20	0.8
Otic agents	4	0.2
Respiratory agents	3	0.1
Hormones	3	0.1
Anaesthetics	1	0.04
Total	2444	100

4.3 CHARACTERISTICS OF WOUNDS

4.3.1 Wound characteristics

Wounds with no specific classification in the records had the highest prevalence at 62.2% (n=152). Classified wounds included abscesses at 14.8% (n=36) fractures at 12.7% (n=31) and others with prevalence below 5% (Table 4.11).

Table 4. 11: **Prevalence of types of wound encountered in domestic cats presented to the six veterinary clinics in Nairobi County, Kenya from January 2007 to December**

Wound type	Number	Percentage
Unspecified wound	152	62.2
Abscess	36	14.8
Fracture	31	12.7
Laceration	7	2.9
Puncture	7	2.9
Avulsion	6	2.5
Cellulitis	2	0.8
Hematoma	2	0.8
Bruise	1	0.4
Total	**244**	**100**

Trauma contributed to 14.8% (n=36) of the wounds, followed by fight wounds from dogs at 13.1% (n=32) and surgical wounds at 8.2% (n=20). In 53.6% (n=131) of the cases, information on the causes of the wounds was not indicated in the case records. Bite wounds from other cats attributed to 7.4% (n = 18) of the cases (Table 4.12). Wounds

involving extremities and parts of the limbs were recorded in 43.6% (n=106) of the cases. Among these, toes, paws, carpus, tarsus were commonly affected and occasionally the elbow and stifle joint regions were involved, but no wounds were recorded in the radius, ulnar and tibia regions. Other areas of the body recorded to have had wounds included facial area at 16.9% (n=41), abdominal area at 9.9% (n = 24), neck regions at 7.8% (n = 19) and vaginal area with only one case (Table 4.13). Only 2.9% (n=7) of the cases had information on the size of the wounds, but records for 97.1% (n=237) of the cases with wounds had no information on size of the wounds. The wound sizes ranged from approximately 0.5 cm to 6 cm in length. The dimensions did not include width and depth.

Table 4. 12: **Prevalence of various causes of wound in the cases of domestic cats presented to the six veterinary clinics in Nairobi County, Kenya from January 2007 to December 2016.**

Cause of wound	Number	Percentage
Not indicated	131	53.6
Trauma	36	14.8
Fights	32	13.1
Surgery	20	8.2
Bites	18	7.4
Others	6	2.5
Burns	1	0.4
Total	244	100

Table 4. 13: **Prevalence of various body regions that had wounds in the cases of domestic cats presented to the six veterinary clinics from January 2007 to December 2016.**

Wound location	Number	Percentage
Limbs	106	43.6
Facial	41	16.9
Abdominal	24	9.9
Neck	19	7.8
Not indicated	19	7.8
Pelvic	18	7.0
Back region	10	4.1
Shoulder	6	2.5
Vaginal region	1	0.4
Total	**244**	**100**

4.3.2 Physical findings on the wounds

Case records indicated that the wounds were presented in various physical states. The domestic cats presented with fresh wounds were 39.1% (n=95) and only 2.1% (n=5) had necrotic tissue. Those presented with discharges/exudates were 30.5% (n=74), which included blood, serum and purulent discharge, while 32.5% (n = 79) of the cases were described in the case records as having dry wounds without any discharge (Table 4.14).

Among the cases in the case records, 38.7% (n=94) were presented with wounds that had infection and 31.7% (n=77) were recorded as having wounds that were not infected. There were only 2 cases recorded in which samples were taken from wounds for culture and sensitivity from which *Staphylococcus aureus* and *Pseudomonas* species were isolated respectively.

Table 4. 14: **Frequencies of the various physical findings on the wounds of the domestic cats presented to the six veterinary clinics in Nairobi County, Kenya from January 2007 to December 2016.**

Wound parameter	Findings	Number (n=244)	Percentage (%)
Necrotic tissue	Present	5	2.1
	Absent	95	39.1
	Not recorded	144	58.8
	Total	**244**	**100**
Discharges/Exudates	Present	74	30.5
	Absent	79	32.5
	Not recorded	91	37.0
	Total	**244**	**100**
Infection	Present	94	38.7
	Absent	77	31.7
	Not recorded	73	29.6
	Total	**244**	**100**
Culture and sensitivity	Done	2	0.8
	Not done	222	91.4
	Not recorded	20	7.8
	Total	**244**	**100**

Among the cases of domestic cats presented to the veterinary clinics with wounds in the 10-year period, 57.38% (n=140) had no indication of presence, absence, or degree of pain in the case records. A total of 24.18% (n=59) of the cases were recorded to have pain but the level of pain was not indicated, 14.34% (n = 35) were recorded as having severe pain and the rest of the data on pain is indicated in Table 4.15.

Table 4. 15: **Frequencies of presence and level of pain caused by wounds of the domestic cats presented to the six veterinary clinics in Nairobi County, Kenya from January 2007 to December 2016.**

Presence /degree of pain	Number	Percentage
No pain indicated	140	57.38
Present but no degree	59	24.18
Severe	35	14.34
Moderate	10	4.2
Total	244	100

4.3.3 Wound management

Several methods and agents were recorded as having been employed for managing wounds in these cases. The most frequently used was antibiotics at 39.3% (n = 96). Records of 39.8% (n=97) of the cases had no indication of use of any agent for managing the wounds, 18.4% (n=45) of the cases had wounds managed by flushing them with tap water or normal saline intravenous infusion (9 grams of Sodium chloride per liter of water). Other agents and methods used to manage wounds in less or about 5% frequencies are presented in Table 4.16.

Table 4. 16: **Frequencies of use of various categories of agents and non-surgical methods of managing wounds in the cases of domestic cats presented to the six veterinary clinics in Nairobi County, Kenya from January 2007 to December 2016.**

Categories of agents and non-surgical methods	Number	Percentage
Systemic antibiotics	96	39.3
No agent	97	39.8
Washing with chlorhexidine and flushing with tap water or normal saline	45	18.4
Anti-inflammatory drugs	4	1.7
Honey	2	0.8
Total	244	100

Surgery was not performed in 68.1% (n = 166) of the cases presented. Primary wound stitching had the highest prevalence at 16.0% (n = 39). Orthopaedic surgeries due to traumatic falls, vehicle accident traumas and fights had a prevalence rate of 6.8% (n = 16), while 2.0% (n = 5) of the cases required reconstructive surgery due to the nature of tissue loss and severity of the wounds (Table 4.17).

Table 4. 17: **Prevalence of each surgical method employed in wound management in domestic cats presented to the six veterinary clinics in Nairobi County, Kenya from January 2007 to December 2016.**

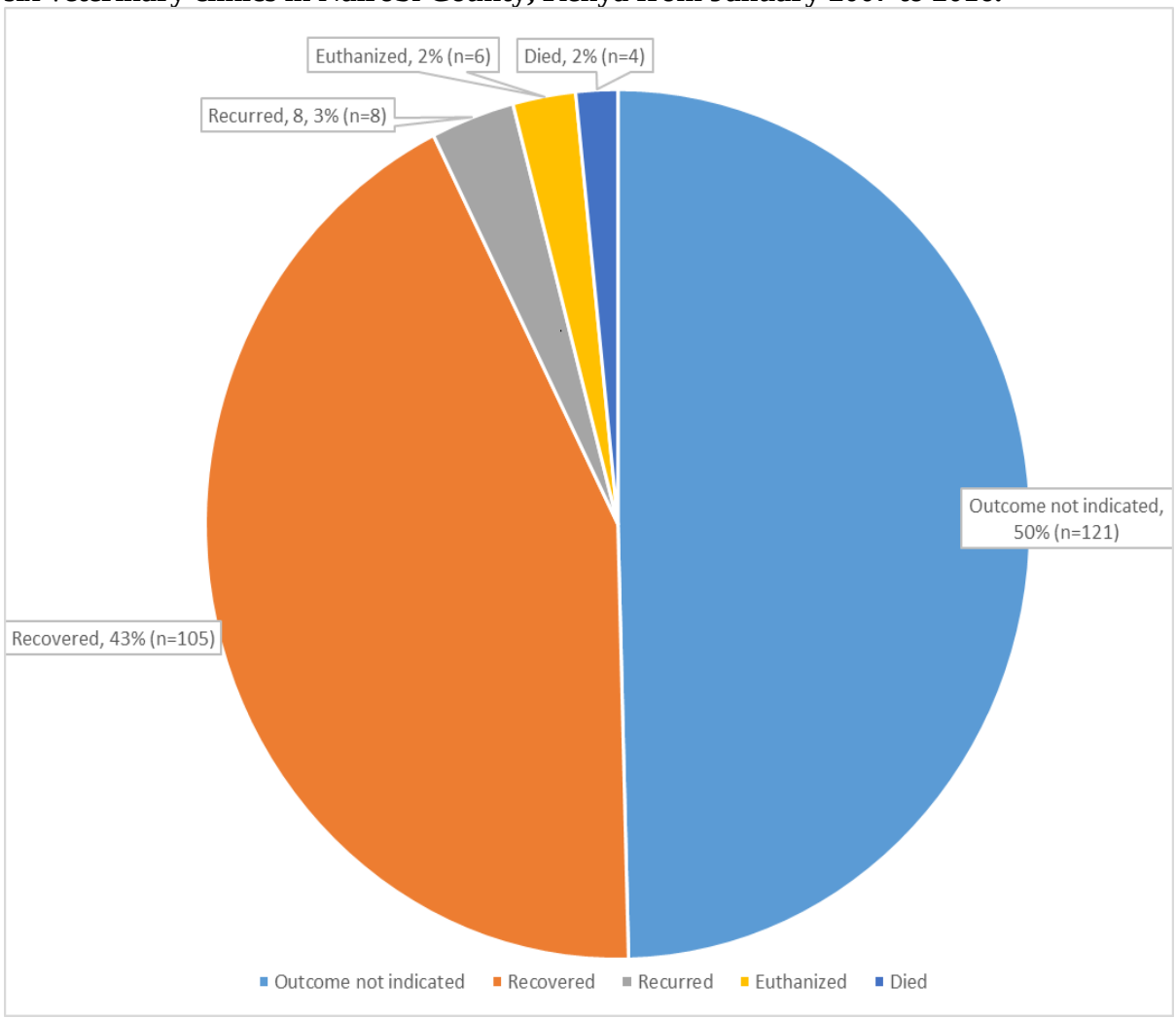
Surgical method used	Number	Percentage (%)
No surgery performed	166	68.1
Primary wound stitching	39	16
Orthopaedic	16	6.6
Lancing	6	2.5
Amputation	5	2.0
Reconstructive surgery	5	2.0
Bandage	3	1.2
Enucleation	2	0.8
Herniorrhaphy	1	0.4
Lumpectomy	1	0.4
Total	244	100

Amoxicillin was used in 61.3% (n = 149) of the cases with wounds. Penicillin and Amoxicillin-clavulanic acid followed at 13.6% (n = 33) and 3.4% (n = 8) respectively. The other antibiotics were used in less than 2% of the cases (Table 4.18). After management of the wounds, 43.2% (n=105) of the cases recovered, 2.5% (n =6) of the cases were euthanized even after attempts of management, 3.3% (n = 8) recurred and were referred back to the clinic for further treatment (Table 4.19).

Table 4. 18: Prevalence of different antimicrobials used in wound treatment in domestic cats presented to the six veterinary clinics in Nairobi County, Kenya from January 2007 to December 2016.

Antimicrobial agent	Number	Percentage
Amoxicillin	149	61.3
No antibiotics administered	40	16.5
Penicillin	33	13.6
Noroclav	8	3.4
Cefalexin	3	1.2
Metronidazole	3	1.2
Gentamycin	3	1.2
Sulfur	2	0.8
Dexamethasone	1	0.4
Enrofloxacin	2	0.4
Total	244	100

Figure 4. 1: Outcomes after wound management in domestic cats' cases presented to the six veterinary clinics in Nairobi County, Kenya from January 2007 to 2016.



4.3.4 Results of univariate and multivariate analysis for association tests

Chi square statistic test revealed that no factor directly influenced the outcome of domestic cats with wounds. Univariate and multivariate analysis found most factors not associated with each other. Cats with infected wounds had twice the likelihood of manifesting pain than those with non-infected wounds ($p=0.047$, $OR=2.19$). Soft tissues had approximately 4 times more likelihood of developing wounds than other tissues ($p=0.026$, $OR=3.7$). High proportion of cases lacked recorded details on every parameter evaluated.

CHAPTER FIVE

5.0 DISCUSSION, CONCLUSIONS AND RECOMMENDATIONS

5.1 DISCUSSION

The results of the current study revealed a low prevalence of wound occurrence in the 10-year period whose records were used for the study. The wounds were mainly soft tissue wounds with occasional bone involvement. The wounds had a higher likelihood of recovery after treatment.

The higher percentage of domestic cats presented to the clinics in the latter than earlier years of the 10-year period is probably due to Nairobi residents adopting the practice of keeping cats and the improved acceptance of cats' medical welfare being taken care by veterinarians. This may also be attributed to increased record keeping in the latter years and missing records in the earlier years. This is in contrast to developed countries, which have digitalized case records in the veterinary clinics that are better managed for ease of retrieval and study (Jones *et al*., 2014).

Double the percentage of intact female and male domestic cats compared to those that are neutered was converse to the finding in a study done in the United Kingdom, which reported approximately four times and three times higher percentages of neutered male and female cats respectively. This was at 40% castrated against 9.8% intact male cats and at 37.5% spayed against 11.4% entire female cats (Elizabeth *et al*., 1999). This can be attributed to attitude and culture of Kenyans, which socially encourages neither care of animals nor financial spending on them. The high percentage (32.2%) of unspecified gender furthers to shows the deficiency existing in the clinics on the discipline and thoroughness of detailed record keeping. The higher number of females compared to males

can probably be explained by owner gender preferences especially due to male cat roaming during mating seasons, as well as more mortality frequencies in males caused by trauma and fights for territory (Hasib *et al.,* 2020).

The high prevalence of 43.0% consisting of domestic cats presented with less than 4 years of age shows that cat owners in Kenya take more care of the younger cats especially to follow vaccination and routine procedures than the older cats. Probably as the cats get older, the owners get less and less concerned about them with regard to medical care. Another high percentage of 41.7% without specification of age further shows the shortcomings in record keeping for these veterinary clinics. The predominantly high percentage of Shorthair breed demonstrated the breed of preference for most domestic cat owners, which was similar to the United Kingdom documented findings previously, which reported as 65.3% for domestic short hair. Similarly, low prevalence for other breeds compares closely with what was reported previously (Elizabeth *et al*., 1999; Fernando *et al*., 2017).

Although more than 50% of the cases in the records of the clinics did not indicate the causes of wounds, trauma and fights were a common cause in the remaining percentage of the cases, closely comparing with previous studies that reported fights as a common cause of abscesses. These were reported to be more common in adult male than female cats, probably due to their roaming behavior that often result in fights with other cats (Hasib *et al.,* 2020, Ozaki *et al.,* 2003). During the fights, bacteria are injected into the bite wounds and into subcutaneous spaces, leading to subcutaneous abscesses that localize near the wounds.

The prevalence of abscesses in the current study is much lower than 6.5% reported in a previous study (Elizabeth *et al.*, 1999), while traumatic injury in the United Kingdom was reported to have a prevalence of 12.9% (O'Neil *et al.*, 2014). This is similar to 12.4% prevalence of wounds found in the current study constituted by soft tissue injuries and fractures. In one study, it was reported that fractures are common in entire male cats, which were two years of age and below and mostly on the long bones of the hind limbs (Catarina *et al.*, 2016). This is probably due to the tendency of male cats to roam outside, which increases likelihood of motor vehicle accidents, falling from heights and other causes of trauma. This led to the increase incidence of cat castrations to reduce the roaming tendencies and reduce incidence of fractures. Although early castration has an effect of delaying fusion of the growth plates, fractures were still encountered in young cats falling from heights (Catarina *et al.*, 2016). In the current study, it was observed that most injuries were obtained through traumatic injury and most fractures were recorded as having been caused by traumatic injury, fights and bite with other cats or dogs.

The recurrent finding in the case records of deficiency in details for every parameter scrutinized, revealed the lack of thoroughness in record keeping for each parameter. This contrasts the protocol that should be followed in examining wounds such as location and size of the wound, tissues involved, degree of contamination and likely bacteria present as well as culture and sensitivity in order to manage wounds appropriately (Anderson *et al.* , 2016; Kulendra and Arthurs, 2014; Ronan Doyle, 2012). The most probable practice for the clinics in the current study may be that examination is done thoroughly but recording of case details is lacking, which poses gross shortcomings for retrospective reference to these records.

The high percentage of cases with unknown outcome is attributed to the high proportion of records with incomplete details, hence the outcome not indicated. The relatively high percentage of domestic cats that are recorded as having recovered may be attributed to the nature of wound treatment and management that the cases were subjected to. The small percentages of those euthanized and those that died was as a result of wounds that were either untreatable or difficult to manage. Euthanasia was in line to alleviate the suffering and put the cats to rest in support of welfare of animals with poor prognosis (Murphy *et al*., 2013).

The high percentage for use of antibiotics for wound treatment especially without first performing culture and sensitivity, is in contrast to findings of a study done in Switzerland, which revealed that antibiotic use in small animals was less than in large animals that largely was done after culture and sensitivity (Schmitt *et al.,* 2019). The high percentage of cases that had wounds treated with antibiotics only allowed the wounds to heal without closure by second intention. This was because of the state in which the wounds were presented, mostly contaminated and having infected exudates. However, the study in Switzerland also revealed that 9.1% of cases had wounds treated without any culture and sensitivity done (Schmitt *et al.,* 2019). The observation in the study of the six clinics that the most prevalent antibiotics used for treatment of wounds was amoxicillin (63.1%) and penicillin (14%), differed from the prevalent use of cephalosporins (36.2%) followed by clavulanic acid potentiated amoxicillin (21.6%) in a previous study (Singleton *et al.,* 2017). In recent years, cefovecin has become the preferred drug by many veterinarians for

use in cats, due to the ease of its administration and its long duration of action, hence eliminating the effort of administering oral medication (Singleton *et al.*, 2017).

Despite the common use of antibiotics for treatment of wounds in the current study, topical treatment by flushing with normal saline 0.9% w/v and chlorhexidine was done in a few of the cases. The need for repeated topical treatments may have discouraged its regular use in comparison to administering antibiotics whose frequency was far less.

Lavage of the wound during and after assessment is important as it washes off gross contaminates, reduces bacteria and toxin load as well as diluting the toxins. It allows proper examination of the underlying tissues. Warm and isotonic fluids for wound lavage are preferred. Flushing using these fluids should be gentle to prevent driving foreign materials deep into the wound and to avoid causing edema of the healthy tissue (Anderson *et al.*, 2016). Other fluids that can be used to flush wounds include tap water, balanced electrolytes such as lactated Ringers and antiseptic solutions. Too much flushing and forceful flushing can cause tissue damage and delay wound healing (Ligi *et al.*, 2016). It was established in one study that sterile tap water and normal saline caused significant cytotoxic damage to fibroblasts after being used, in comparison to phosphate-buffered saline and Ringers lactate solution (Schmitt *et al.*, 2019).

The small percentage of cats whose wounds were sutured had wounds that were presented before occurrence of gross contamination and infection; and those that underwent reconstructive surgery were presented with tissue loss which was deep and severe. Reconstructive surgery, commonly performed on traumatic and avulsed wounds requires the surgeon's experience, understanding of the physiology of wound healing and the anatomy of the region. It can be more economical and a time saving procedure in reference

to time a wound takes to heal by second intention after episodes of repeated dressing (Anderson., 1996). For all skin wound closure methods employed, there are 7 basic principles of wound healing that were employed by Halstead in the 19th century: strict asepsis, gentle tissue handling, accurate hemostasis, maintenance of adequate blood supply, careful approximation of tissues, avoidance of tension in tissues, and obliteration of dead space (R. Doyle, 2012).

Surgical repair of fractures is the more appropriate management of fractures in cats mainly for more accurate and fast bone healing. This is the reason for more surgical repair indicated in the case records compared with external coaptation cast bandage management. The high percentage of the cases recovered indicates that when the wounds are managed using antibiotics and topical therapy, there are high chances of healing. This is further evidenced by the low percentages of cases with recurrence, euthanasia and death. However, the finding of approximately 50% of the wound cases whose outcome was not indicated in the case records, which further confirms the incompleteness of record keeping that lack essential case details. There seemed to be an association between the neuter status of the domestic cats and occurrence of soft tissue injury ($p = 0.03$). The apparent finding of entire cats being more prone to soft tissue injury than neutered cats is similar to studies that observed in entire animals especially males tending to roam and fight with other cats, which decreased after neutering. This prompted clients to be advised to neuter their cats to decrease the incidence of wounds and abscesses from cat fights (Elizabeth *et al.,* 1999; Ozaki *et al.,* 2003).

Despite there being no association in this study, it was recorded that Infection in wounds is detrimental in healing by overcoming the body's immune system due to their number of virulence. These bacteria prolong the progression to the reparative stage by occupying the macrophages (R Doyle, 2012). Opportunistic pathogens are the common etiology such as *Pseudomonas* and *Proteus* which are commonly resistant to most antibiotics hence a culture and sensitivity is paramount to decide on the best one to use. Contaminated wounds may often lead to myositis, fasciitis, necrotizing dermatitis and deep tissue cellulitis. Infection delays wound healing by prolonging the inflammatory phase of wound healing and leads to pain. It does this by causing bacteremia and septicemia which prolongs the duration in which inflammatory cytokines are released. Inflammation leads to the degradation of the extracellular matrix through the production of metalloproteases. The pathogens that cause infection also create a biofilm around the wound which protects them from conventional antibiotics and increases their resistance capability (Guo and DiPietro, 2010).

The statistical significance of association between pain and infection in the wounds can be explained by the influence of infection on the inflammatory reaction. Inflammatory reaction endeavours to decontaminate the wound of all infecting microorganisms (Guo and DiPietro, 2010). Infection stimulates more and continued inflammation, which makes the wound painful since pain is one of the cardinal signs of inflammation, hence the association between wound infection and pain. The likelihood of soft tissue injuries occurring being higher than occurrence of bone injuries can logically be attributed to the fact that the soft tissues are more delicate than bone tissue. Moreover, the bone is covered

and protected by the soft tissue, which further increases the possibility of the superficially sited soft tissue more vulnerable to injury than the deep-sited bone.

The greater percentage of domestic cat case records that was grossly devoid of important case clinical case details largely influenced the results. The results, especially those of univariate and multivariate analysis as well as percentage occurrences of various parameters and factors are likely to be different if the records were thoroughly complete with every relevant detail. However, the current results objectively indicate the status of domestic cats that had wounds and surgical operations in the 10-year period from which records were drawn.

5.2 CONCLUSIONS

The study has made the following conclusions:

1. The prevalence of wounds and surgical procedures in domestic cats in the ten years evaluated is generally low. The low prevalence may be contributed by the high percentage of the cases whose records were grossly lacking details.
2. The main characteristics found on the recorded wounds were swelling, infections with exudates and occasional necrosis.
3. The main wound management method was by use of systemic antibiotics, supported only occasionally by topical application of antimicrobial agents.
4. With treatment, wound healing and recovery of the cats was averagely high.
5. Wound treatment protocol was inconsistent with good management guidance, which includes culture and sensitivity that was lacking in these clinical practices.

6. Record keeping in all the veterinary clinics was poor with reference to much relevant details that was lacking. This posed a challenge for the retrospective study.

5.3 RECOMMENDATIONS

The following recommendations can be made from this study:

1. Record keeping should be improved with inclusion of all relevant case details. Electronic digitization of the records would greatly improve the preservation as well as
3. essential. retrieval of information.
4. 2. Education of cat owners of the importance of having their cats attended by veterinarian as part of good animal welfare practice would be paramount.

Wound management protocol where every important step is done is

A prospective study on health condition of domestic cats in the homes would give more accurate results on whether cats are well taken care of or not.

6.0 REFERENCES AND APPENDICES

6.1 REFERENCES

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6.2 APPENDICES

Appendix 1: Data Collection Sheet: Bio Data

CASE NUMBER	YEAR	BREED	SEX	AGE	WEIGHT	NEUTERED STATUS	NUTRITIONAL STATUS	CLINICAL SIGNS	SOFT TISSUE INJURY

Appendix 2: **Data Collection Sheet: Wound Characteristics**

Case no	Type	Origin	Location	Size	Necrotic tissue	Exudate type	Depth	Infection	Pain

Appendix 3**: Data Collection Sheet: Wound Management**

Case no	Culture and sensitivity	Organism present	Conservative	Surgical