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Incidence of dog bite in Al Muthanna governorate including injuries and its clinical healing in the human

Hussien Majeed ; Mustafa Hamed

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Supervised by

Dr. Karima Al Salihi

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Dedication

الأهداء

إلى معلم البشرية وهاديها ، إلى النور المبين ، إلى رسول الله صلى الله عليه وآله وسلم ...

وإلى من رضا الله برضاها ، إلى أمي وأبي ، إلى سندي في شدتي ورخائي ...

إلى الذين ينظرون إلي بعين المحبة والاحترام ، إلى أخوتي وأخواتي
إلى من تابعني ونصحتني ووجهني حتى أتممت بحثي ، إلى أستاذتي الفاضلة ..

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إلى بلدي الجريح العراق الحبيب ...

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كما أسجل شكري وتقديري إلى أساتذتي المشرفة الدكتورة (كريمة عاكول الصالحي) لما أحاطتني به من رعاية علمية ، وما بذلته من جهد ووقت ثمين ، ومنحتني ثقة وإيمان بعلمي ...

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وإلى جميع أساتذتي في جامعة المثنى / كلية الطب البيطري.. وأتقدم بالشكر الجزيل لكل من مد يد العون من التوجيه وتوفير المصادر ...

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الخلاصة

هناك ارتفاع في عدد الكلاب السائبة في المحافظات العراقية المختلفة. إضافة لذلك , هناك ازدياد في رغبة الناس لاقتناء الكلاب. في كل سنة هناك اعداد مختلفة للاشخاص الذين يعانون من عضات الكلاب في جميع انحاء العراق. وتعتبر الجروح الناتجة من عضات الكلب شائعة في الاعمار المختلفة للسكان ولكنها اكثر حدوثا في الاطفال. اعداد كبيرة من عضات الكلاب تتواجد في مناطق مختلفة من جسم الانسان مع ارتفاعها في الاطراف العلوية. توجد معلومات قليلة جدا وتكاد معدومة عن عضات الكلب في محافظة المثنى وكذلك عن مراحل شفاء الجروح الناتجة من عضات الكلب. لذلك , فان هذه الدراسة صممت لدراسة نسبة عضات الكلب في محافظة المثنى مع التركيز على وصف مراحل شفاء جروح عضه الكلب في احد الحالات المرضية. قام الباحثون باجراء مراجعة في سجلات مستشفى السماوة العام وذلك للبحث عن المعلومات المتوفرة بخصوص المرضى الذين قاموا بزيارة المستشفى وطلب العلاج بسبب تعرضه لعضات الكلب. وقد امتدت هذه الدراسة من شهر كانون الثاني 2016 ولغاية الشهر تشرين الاول لسنة 2016. وقد تم تحليل وتسجيل النتائج احصائيا. خلال فترة الدراسة فانه هناك 176 انسان قام بزياره الطوارئ بسبب عضات الكلب. بين هؤلاء الاشخاص هناك 41 انثى و135 ذكر وبنسب مئوية امتدت بين 23.295% و 76.704% على التوالي .

وعلاوة على ذلك، كان معدل عضات الكلب بين الفئات العمرية كما يلي، وكان هناك 0 (%0) و 5 (%3) و 57 (%32) و 88 (%50) و

26 (15%) لأقل من واحد سنة، 1-4 سنوات، 5-14 سنة، 15-45 سنة وأكثر من 45 عاما على التوالي. بلغ العدد الإجمالي لسكان محافظة المثنى 775×1000 نسمة وفقا لتقدير العراق الكلي (أبريل 2009). وتبعاً لذلك، بلغ معدل الإصابة الكلي لعضات الكلاب في محافظة المثنى / 100.000 نسمة 22.709% من مجموع السكان. وقد سجلت إصابة واحدة بمرض داء الكلب (السعار) وبنسبة إصابة 0.568% من العدد الكلي لعضات الكلب. كما بلغت نسبة داء الكلب لمجموع سكان محافظة المثنى 0.129 / 100.000. وامتد شفاء عضات الكلب لمدة 3 أسابيع مصحوبة بتكوين الندبة المنخفضة وسطياً.

في الخلاصة، ولمعرفة الباحثين فان هذه الدراسة هي الأولى التي اثبتت حدوث عضات الكلب في محافظة المثنى. واطهرت الدراسة ايضاً ارتفاع معدلات الإصابة بين المرضى من الفئة العمرية 15-45 سنة، تليها 5-14 سنة. وعلاوة على ذلك، كان معدل الإصابة لعضات الكلب أعلى في الذكور من الإناث. واطهرت الدراسة على حدوث داء الكلب في حالة واحدة بين مجموع عضات الكلاب. وأوصى الباحثون بإجراء دراسة مستقبلية أخرى تتضمن المزيد من السنوات السابقة لتحديد الوضع الفعلي لعضات الكلاب التي تشكل مشكلة صحية خطيرة في المثنى وكذلك في محافظات عراقية أخرى.

Abstract

Background

There are elevations in the number of stray dogs in different governorates in Iraq. Moreover, the number of people who are interested in keeping dog for life purpose has also risen. Every year, there are a number of populations contacted to animal bites throughout the country. Wounds due to dog bites are popular in different human ages, but are more common in children. A high rate of these dog bites affect different body locations, however, upper extremities are more common site. There is scarce information describing dog bites in Al Muthanna governorate, in addition to describe its healing process. Therefore, this study intends to report the prevalence of dog bites in Al Muthanna governorate and to describe the clinical healing process of pet dog bites in their owner arm.

Materials and methods

The authors retrospectively reviewed the records of dog bites who sought emergency department at Al Muthanns hospital in Samawah city from January 2016 to November 2016 (totally 11 months). The data were analyzed and percentages of prevalence were reported.

Results

During the study period, there were 176 people's emergency department visits for dog bites. Among the 176 person with dog bites, there were 41female and 135 male with percentages of 23.295% and 76.704% respectively. Moreover, the incidence of dog bites was varied between the victims age group, there were 0 (0%), 5(3%), 57 (32%), 88 (50%) and 26 (15%) for less than one year, 1-4 years, 5-14 years, 15-45 years and more than 45 years respectively. The total population of Al Muthanna governorate was 775 X 1000 according to total estimation of Iraq (April 2009 IMF estimate). Accordingly, the total incidence rate of dog bites in Al Muthanna governorate/ 100.000 people was 22.709 % for the total

population. One patient revealed clinical signs of rabies with percentage of incidence 0.568% for the total dog bites. Moreover, the percentage of rabies for total population for Al Muthanna governorate was 0.129/100.000. The time and healing process of dog bites extended for 3 weeks with formation of scar centrally depressed area.

Conclusions

In conclusion, for the authors' knowledge this is the first study that approved the incidence of dog bites in Al Muthanna governorate. The higher incidence percentages of dog bites occur between the patients of age group 15-45 year and followed by 5-14 years. Moreover, the incidence rate of dog bites was higher in male than female. The study approved the incidence of rabies in one case between the total dog bites. The Authors recommended another future retrospective study that reviewed more years to determine the actual situation of the dog bites that act as a serious health problem in Al Muthanna as well as in another Iraqi governorates.

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Incidence of dog bite in Al Muthanna governorate including injuries and its clinical healing in the human

Introduction

Dogs is considered a part of human history inconsideration before the recoded verbalism. It is actually the history of partnership between the human being and dogs (*Canis lupus familiaris*). The first domesticated dogs were in Mesopotamia (2150-1400 BCE), that so far regarding to the area of what is recently the Republic of Iraq. Mesopotamia included the Euphrates and Tigris river systems and is regarded by many to be the cradle of civilization (Livingstone, 1988). The dog appeared in the Epic of Gilgamesh. The ancient arts and statue expressed the companions of one of the popular goddesses of the region, moreover, it showed also that the goddess Innana (Ishtar) travels with 7 prized hunting dogs wearing the invented collar and leash that prior to Egypt. The Suluki dog (golden) was appeared at the Sumerian city of Uruk at 3300 BCE and cylinder seal from Nineveh. The laws of Eshunna, a Sumerian city in ancient Mesopotamia, were reported the first observations of disease that occurred due to dog bites and compatible with rabies. The Eshunnian laws, written almost 4000 year ago, and caution of fines for owners of uncontrolled dogs (Crazy or mad dogs) that bite human (Theodorides,1986). Moreover, the law of the old Babylonian period (1894 -1595 BC) addressed the damage that caused by animals especially the dog bites (Zietsman, 2000).

Human-dog partnership is established on a human demand for help with chase and shepherding, and for the early warning security system. Recently, there are significant global increased in the interest of people in having a dog. Pet dogs give love, happiness and companionship for millions of people around the world, however accident and a health hazard occurred (Aristarhos & Darem., 2014). The wonderful friendship between dogs and humans is at an indefinite time interrupted by dog bites that can be highly serious.

Dog bites are most common health matter, causing morbidity and in scarce cases can cause mortality. Bites of the pet dog are serious for several different reasons. The oral cavity of the pets harbor several microorganisms that can cause serious infectious diseases and life-threatening infection, when deposited deep into tissue. Mouth microorganisms linked with sharp teeth that can either rupture or breaking though flesh easily create a dangerous combination.

There are 10 million people who are bitten by animals worldwide each year, and there are 55.000 people infected with rabies according to the WHO data. Dog bite wounds are usually considered as complex injuries and contaminated with polymicrobial inoculum. In India, WHO survey showed that dog was the major causative source of which 62.9 and 37.1 were stray and pets dag respectively (Sudarshan, 2005).

In United States, bites of animal are an immensely popular health matter and leading to considerable morbidity and in scarcely cases mortality (Mcheik *et al.*, 2000; Borud and Friedman, 2000). The majority of animal bite injuries are caused by dogs, while cat bites are the second (Mitchell *et al.*, 2003). Annually, eight hundred thousand (800.000) Americans look medical care for dog bites, where 386.000 need treatment in an emergency unit (Lackmann *et al.*, 1992). Moreover, in United States, the dog bites alone commissioned one billion Dollars per year (Marcy, 1982).

In Iraq, there are high number of free- roaming ownerless dog. There are no planned sterilization campaigns to control dog population, however, culling of dog has been used traditionally. Some of these dogs are attach human especially the children and farm animal and bite them. Moreover, and due to the security issue, in Iraq, nowadays high percentage of Iraqi people keeping dogs and most farmers keeping one or more of dogs from different breeds. These dogs are subject to tough training regime to attack the robbers and the suspected people, and ultimately, these dogs become vicious and attack their owners.

Horton *et al.*, (2013), reported the incidence of dog bites in Baghdad. They found less than 1000 dog bites that reported between years 2002 to 2004. The incidence rate was 20(95% CI 18.76-21.24) bites / 100,000 person, based on a population estimate of 5 million (Roberts *et al.*, 2004). However, the dog bites incidence rate in Baghdad was increased later in years between 2007 and 2010. The reported average was 3300 bites per year with annual incidence of 46 (95% CI 44.27-47.40) bites per 100.000 person with a population estimate of 7.2 million.

The incidence rate of dog bites overall Iraq was 57 bites per 100.000 population in 2007 with total reported dog bites were 17000, however, the real number might be higher. Most reported dog bites were reported from Salah-eldin, Baghdad, Babil, Theqar, Missan, Wasit, Basra, Diwania, with total number of 845, 4610,1050,713,512,1430, 2400,722 respectively for each governorate.

Aims of study

No previous report or literature has been reported regarding the incidence of dog bites in Al Muthanna governorate. In addition, review of literatures, did not revealed any record that reported the clinical healing process of dog bites in Iraq. Consequently, this study intends to study the incidence of dog bites in Al Muthanna governorate and to describe the clinical healing process of pet dog bites in their owner arm.

Review of literature

Animal and human bite wounds represent a significant global health issue (Esposito *et al.*, 2013). In the United States, animal bites are a very common health issue, causing significant morbidity and even, in rare scenarios, mortality. Most animal bite wounds in the United States are caused by dogs, with cat bites being a distant second.³ Each year, 800,000 Americans seek medical attention for dog bites: 386,000 require treatment in an emergency department. Dog bites cost more than \$1 billion per year in the United States alone. Antibiotic prophylaxis is recommended only in patients with high risk wounds; primary closure is recommended in patients with low-risk wounds (Speirs *et al.*, 2015).

Dog Bites

Dog bites frequently occur in individuals who own the dog as a pet (or in their immediate family members). Patients of dog bites frequently know the dog that attacked them. Of the 3 to 6 million animal bites per year in the United States, approximately 80% to 90% are from dogs (Presutti, 2001).

Patient's Age and Sex

Most dog bites occur in children, with the highest number in boys between the ages of 5 years and 9 years. (Sacks et al., 1996) Dog bite wounds are more common in males.⁹

Anatomic Region

In children through the age of 9 years, the head and the neck are the most common sites of dog bites. In children who are 10 years or older and in adults, the arms and the legs, particularly the right hand, are the most common sites (Hon *et al.*, 2007).

Injury Characteristics

A dog bite can lead to a range of injuries, including scratches, deep open cuts, puncture wounds, crush injuries, and the tearing away of a body part. Dogs, because of their rounded teeth and strong jaws, typically cause crush injuries when they bite. An adult dog can exert 200 pounds per square inch (psi) of pressure; some large dogs can exert 450 psi (Rottweiler, 328 psi; Malinois/German shepherd, 238 psi; bulldog/pit bull, 235Y305 psi). Because of the substantial biting force exerted by trained police dogs, injuries associated with these bites differ significantly from those observed in civilian dog bites. In a study of 705 dog bites sustained by jail ward patients in Los Angeles between 1988 and 1995, 19.3% involved complications. These included fractures and cortical penetration in 4%, vascular injuries in 7%, nerve injury in 1.9%, and infections in 5%, as well as tendon injuries and joint disruption (Hutson *et al.*, 1997).

Mortality

Each year in the each countries worldwide, such as in USA dog attacks kill approximately 20 to 35 people, many of them young children. Of fatal dog bites in which a breed could be identified, 28.6% were caused by pit bulls, according to a recent US study (Hutson *et al.*, 1997).

Cat Bites

Cat bites are the second most common type of animal bites in different countries, accounting for approximately 5% to 15% of animal bite wounds, with an estimated annual incidence of 400,000.¹³ Most cat bites result in minor injuries, however, with most victims not seeking medical attention. Feline attacks are underreported because many people consider injuries from cats to be less serious than those caused by dogs and may not seek medical attention. This theory is supported by results from a 2006 Belgian study, which found that although 75% of dog bite patients presented within 24 hours of the attack, all of the patients injured by cats presented relatively late, only after complications had developed (Griego *et al.*, 1995). Nonetheless, approximately 6% of patients with cat bite wounds require hospitalization.

Patient's Age And Sex

Cat bites are more likely to occur in older individuals (defined as those who are at least 75 years old). Women are more frequently bitten by cats (Philipsen *et al.*, 2006; Smith *et al.*, 2000).

Anatomic Region

Cats can cause wounds with their teeth or claws. Two thirds of cat bites involve the patient's upper extremities (arms and hands). Scratches typically occur on the upper extremities or face. Studies have shown that 60% to 67% of cat bite wounds occur on the upper extremities, 10% to 13% on the lower extremities, 15% to 20% on the head and neck, and fewer than 5% on the trunk (Philipsen *et al.*, 2006).

Injury Characteristics

Of individuals with severe cat bites who seek medical attention, puncture wounds affecting the hands or extremities are common. Cat bites are more likely to penetrate deeply, particularly into the bones and joints, leaving only a small skin opening from which fluids can drain. Therefore, deep abscesses and osteomyelitis are more common with cat bites.

Mortality

The reported mortality rate in the literature ranges from 0.5% to 1.2%.

Management of animal bites

Most bite wounds can be treated in the emergency department. The essentials of treatment include the history, inspection, irrigation, debridement, and if indicated, closure. (Table.1) and highlight the important components of history and initial wound management.

Inspection

The wound should be carefully inspected to identify any deep injuries and devitalized tissue. Anesthesia is usually necessary; otherwise, an adequate inspection is nearly impossible. Care should be taken to visualize the bottom of the wound and, if applicable, to examine the wound through a range of motion. In case of snake bite, if pressure immobilization is in place, hospital personnel should not remove it until monitoring, complete assessment, or if needed, intravenous antivenom is being provided. Antivenom, if indicated, should be given before the removal of pressure immobilization. If antivenom is not indicated, then the first aid should be removed. Every patient with animal bites to the periocular area should be assessed for eyelid lacerations, medial and lateral canthus tendon lacerations or disinfection, canalicular lacerations, and facial fractures. Equally important, in every patient with soft tissue injuries to the face or skull, the high possibility of underlying fractures should be considered, and appropriate imaging should be performed (Chippaux *et al.*, 1998). In terms of snake bites, the clinician should examine the bite site

and the surrounding region specifically for the following: presence of fang marks (e.g., single or multiple punctures or scratches) and swelling or tenderness of regional lymph nodes indicating venom spread.

TABLE 1 Wound Management After Dog, Cat, or Human Bites

| |
|---|
| Obtain culture (in case of abscess, severe cellulitis, devitalized tissue, or sepsis) |
| Use saline solution for wound irrigation. |
| Debride necrotic tissue, and remove any foreign bodies. |
| Obtain radiographic study (in case of fracture or bone penetration). |
| Initiate prophylactic antibiotics in selected patients, depending on type of dog or cat involved. |
| Hospitalize patient (in case of fever, sepsis, spreading cellulitis, severe edema, or crush injuries). |
| Consider hospitalization for patients who are immunocompromised or are likely to be noncompliant. |
| Administer tetanus booster (if none given in the past year), or initiate primary series in nonvaccinated individuals. |
| Assess the need for rabies vaccine and immunoglobulin administration. |

Irrigation and Debridement

Irrigation is one of the most important means of infection prevention. The bite wound should be rinsed and covered with a sterile dressing. To clean most bite wounds, a 19-gauge blunt needle and a 35-mL syringe provide adequate pressure (7 psi) and volume. In general, 100 mL to 200 mL of irrigation solution per inch of wound is required. Heavily contaminated bite wounds require more irrigation. Large dirty wounds may require irrigation in the operating room. Isotonic sodium chloride solution is a safe, effective, inexpensive, and easily available irrigating solution. Debridement should be considered in dirty wounds and has been shown to be effective in preventing infection. Surgical debridement is suggested for the wound edges and nonviable tissue, using sharp debridement. Minor animal bites in adults should be repaired in the emergency department. In children and adults with severe injuries, the repair should usually be performed in the operating room (retrospective, case series).

Primary Versus Delayed Closure

The literature on wound closure after animal and human bites presents differing recommendations. Although the role of suturing in dog bite wounds is well discussed in the literature, several issues remain controversial. Traditionally, it was suggested to leave these wounds open because of the proposed increased risk of wound infection when sutured. However, there are reports indicating that suturing of animal wounds does not necessarily increase the incidence of infection. In a review article on dog bite wounds, (Stefanopoulos *et al.*, 2005) recommended primary repair as the treatment of choice for most bites, except for complicated or infected wounds. In a review article on animal and

human bite wounds, (Goldstein *et al.*, 1992) recommended delayed primary closure for infected wounds. Wu *et al.*, (2011) recommended primary repair of pediatric facial dog bite injuries, including complex soft tissue injuries, in conjunction with antibiotic administration (retrospective, case series). In a retrospective analysis of head and neck wounds from dog bites in pediatric population, Monroy *et al.*, (2009) recommended adequate irrigation and debridement before primary repair. In this study, the post procedure wound infection rates were 10% (retrospective, case series). Chen *et al.*, (2000) recommended primary closure in dog, cat, and human bites. Their post procedure wound infection rates were 6% (retrospective case series).

In a prospective randomized trial of all types of dog bite wounds, Chen *et al.*, (2000) found no difference in wound infections and cosmeses between primary repair and leaving the wound open (randomized trial). Similarly, in a randomized clinical trial, the authors concluded that the facial laceration of dog bite wounds should be primary closed immediately after formal and thorough debridement, and the primary closure would shorten the healing time of the dog bite wounds without increasing the rate and period of infection (randomized trial). In a randomized cohort study, Xiaowei *et al.*, (2013) found that, in the primary closure group, four patients (6.7%) developed a wound infection; in the delayed closure group, three patients (5%) did ($p = 0.093$); no patients developed a systemic infection. However, Xiaowei *et al.*, (2013) also noted that, in the primary closure group, 55% of the patients had optimal cosmetic scores, as compared with 33.3% in the delayed closure group ($p = 0.012$) (randomized trial). A study by Gurunluoglu *et al.*, (2014) indicated that the optimal treatment of facial dog bites requires that Level I trauma centers have a plastic surgery service available. In a study of 75 patients whose facial dog bite injuries who were treated only by a plastic surgery service (with 60 of 98 total wounds being treated by direct repair), the investigators reported that good outcomes were achieved by direct repair and reconstruction of these injuries as early as possible, with a low complication rate and a high rate of patient satisfaction achieved (retrospective, case series). Yet, other studies do not support primary closure of animal bite wounds but instead recommend leaving them open, initially, in these two circumstances, namely, if they are puncture wounds rather than lacerations involving the legs and arms, or if more than 6 hours to 12 hours elapses before the patient seeks treatment (Level V). Such wounds may be treated by delayed primary closure or may be left to heal by secondary intention (Level IV). Other retrospective analysis of cat bites of the hand recommended that treatment with antibiotics, surgical drainage, debridement and copious irrigation, and the use of corticosteroids in some cases proved to be effective. Hand elevation and intensive physiotherapy after a short period of immobilization is critical (retrospective, case series). Human bite wounds should be irrigated copiously with sterile saline, and grossly visible debris should be removed (retrospective, case series). Surgical evaluation of bite wounds is critical for assessing nerve and muscular function as well as the extent of injury to the tendons, bones, and joints. If debridement is needed, it should be performed cautiously, to avoid enlarging the wound and impairing skin closure. Debrided material should be sent for aerobic and anaerobic culture analysis (retrospective, case series). Donkor and Bankas, (1997) studied 30 patients who presented with human bites of the face and noted that a thorough debridement followed by primary closure, direct suturing, a local flap or skin grafting on the day of presentation resulted in 90% complete wound healing (retrospective, case series). A recent case series indicated that locally injected hyaluronidase may aid in

decreasing the edema and increasing perfusion in face bites that present late, thus permitting wound closure without tension. Subcutaneous sutures should be used sparingly, since foreign material in a contaminated wound increases the risk of infection. Elevation of the injured area is useful to reduce swelling and pain.

Prophylaxis

For all animal bite wounds, tetanus and rabies prophylaxis should be considered. Fresh bite wounds without signs of infection should not be cultured. Other laboratory tests may be indicated, depending on the patient's condition (e.g., for patients with sepsis, a complete blood count and blood cultures).

If *Capnocytophaga canimorsus* sepsis is suspected, the peripheral smear should be examined for the causative organism, a bacillus. Table 2. highlights the common organisms causing infection after animal and human bite.

Antibiotics

The appropriate use of antibiotics is one of most controversial subjects in wound care. The goal of initial antibiotic therapy is to cover anaerobes and *Staphylococcus*, *Streptococcus*, and *Pasteurella* species (Table 3). Prophylactic antibiotics may be given for a 3-day to 5-day course (Table 4).

TABLE 2 Organisms Causing Infections After Bites

Cat bites

- *Pasteurella* species, *Streptococcus* species
- *Staphylococcus* species, *Moraxella* species
- *Fusobacterium* species, *Bacteroides* species
- *Porphyromonas* species

Dog bites

- *Pasteurella* species, *Streptococcus* species
- *Staphylococcus* species, *Neisseria* species
- *Fusobacterium* species, *Bacteroides* species
- *Porphyromonas* species, *Prevotella* species
- *Capnocytophaga* species

Human bites

- *Viridans streptococci*
 - *Streptococcus pyogenes*, *S. aureus*
 - Anaerobes *E. corrodens*
 - Hepatitis B and C
 - HIV
-

TABLE 3 Antibiotic Guidelines After Dog, Cat, or Human Bites

Infection not established

- Amoxicillin + clavulanate (child, 22.5 + 3.2 mg/kg up to 875 + 125 mg) orally, 12 doses hourly for 5 d
- If commencement of above is likely to be delayed, procaine penicillin (child, 50 mg/kg up to 1.5 g) intramuscularly, as 1 dose, followed by above

Infection established

- Metronidazole (child, 10 mg/kg up to 400 mg) orally, 12 doses hourly for 14 d + EITHER
- Cefotaxime (child, 50 mg/kg up to 1 g) intravenously daily for 14 d OR
- Ceftriaxone (child, 50 mg/kg up to 1 g) intravenously daily for 14 d OR
- Piperacillin + tazobactam (child, 100 + 12.5 mg/kg up to 4 + 0.5 g) intravenously, 8 doses hourly for 14 d OR
- Ticarcillin + clavulanate (child, 50 + 1.7 mg/kg up to 3 + 0.1 g) intravenously, 6 doses hourly for 14 d

For patients with immediate penicillin hypersensitivity

- Metronidazole (child, 10 mg/kg up to 400 mg) orally, 12 doses hourly for 14 d + EITHER
 - Doxycycline (child > 8 y, 5 mg/kg up to 200 mg) orally for the first dose, then 2.5 mg/kg up to 100 mg orally, 12 doses hourly OR
 - Trimethoprim + sulfamethoxazole (child, 4 + 20 mg/kg up to 160 + 800 mg) orally, 12 doses hourly OR
 - Ciprofloxacin (child, 10 mg/kg up to +500 mg) orally, 12 doses hourly
-

TABLE 4. Organisms Causing Infections After Bites

Cat bites

- *Pasteurella* species, *Streptococcus* species
- *Staphylococcus* species, *Moraxella* species
- *Fusobacterium* species, *Bacteroides* species
- *Porphyromonas* species

Dog bites

- *Pasteurella* species, *Streptococcus* species
- *Staphylococcus* species, *Neisseria* species
- *Fusobacterium* species, *Bacteroides* species
- *Porphyromonas* species, *Prevotella* species
- *Capnocytophaga* species

Human bites

- *Viridans streptococci*
 - *Streptococcus pyogenes*, *S. aureus*
 - Anaerobes *E. corrodens*
 - Hepatitis B and C
 - HIV
-

Treatment of Dog Bites

The first-line oral therapy is amoxicillin-clavulanate (Level III). For patients with higher-risk infections, a first dose of intravenous antibiotic may be given (e.g., ampicillinsulbactam, ticarcillin-clavulanate, piperacillin-tazobactam, or a carbapenem). Other combinations of oral therapy include cefuroxime plus clindamycin or metronidazole; a fluoroquinolone plus clindamycin or metronidazole; sulfamethoxazole and trimethoprim plus clindamycin or metronidazole; penicillin plus clindamycin or metronidazole; amoxicillin plus clindamycin or metronidazole; and, although less effective, azithromycin or doxycycline plus clindamycin or metronidazole (Level III). If the wound is infected when the patient first arrives, a course of 10 days or longer is recommended. The role of cotrimoxazole in patients with dog bite wounds, found a wound infection rate of 13.8% in the placebo group versus 5% in the treatment group (randomized double blind). In a study of dog bite wounds in 39 children, Skurka *et al.*, (1986) found that those who received penicillin V-K (100,000 U/kg/d every 6 hours) had a wound infection rate of 10.2% versus 5% in the placebo group (randomized double blind). A meta-analysis of 8 published studies on prophylactic antibiotics in patients with dog bite wounds estimated that approximately 14 patients would have to be treated to prevent one infection; a subanalysis of the data found that prophylactic antibiotics had a protective effect specifically in patients with hand bites. The authors of both the meta-analysis and subanalysis concluded that the use of prophylactic antibiotics should be limited to patients with dog bite wounds who have a high risk of infection, although “high risk” was not defined. A sub-analysis of hand bites

(in patients with dog, cat, and human bites) showed that infection rates were significantly reduced by prophylactic antibiotics: only four patients would need to be treated to prevent one infection.

Mechanisms of dog bite

Dog bite can cause a serious health problems. There are three mechanisms for dog bite. These includes:

1. Trauma: It is one of the first sequela of a bite that impose the tissue. Skin surface abrasion, penetrated injuries, varying degrees of laceration loss of tooth, truncation, and tearing down of skin and hair are the most common traumatic effects of dog bite. Moreover, severe hemorrhage due to broken blood vessel may occur (Cherry, 2014).

2. Infection: Different pathogenic microorganisms can be introduced into the bite. Pathogenic microorganisms can arise from the mouth of the biter dog, but the microorganism that exist normally on the skin or hair of the injured person may also promote and enhance the infection. The more common microorganisms that have been reported and causing infections after dog bite, included: *C. tetani*, *C. perfringens*, *Pasteurella sp*, *Streptococcus sp*, *Staphylococcus sp*, *Neisseria sp*, *Fusobacterium sp*, *Bacteroides sp*, *Porphyromonas sp*, *Prevotella sp*, and *Capnocytophaga sp*. (Hassan Aziz *et al.*, 2012). Moreover, *Capnocytophaga Canimorsus* Septicemia Caused by a Dog Bite was reported by Hammoud *et al.*, (2011). This organisms is more dangerous due to its ability to produce sepsis especially in immune-compromised individuals. It is also well known that any dog bite can result in local infection and cellulitis and even serious conditions such as sepsis, meningitis, osteomyelitis and septic arthritis.

3. Rabies: Dogs bites most commonly transfer rabies virus to human. According to WHO, approved that more than 95% of human death due to rabies result from transporting virus via infected dogs bite (WHO, 2016). The clinical signs of rabies include hydrophobia, red eyes, jerky behavior, foaming from the mouth, self-mutilation and growling (WHO, 2016).

In Iraq, human rabies incidence were reported every year from all governorates public health office due to stray dog bite. There was significant increase in rabies cases annually between 2003 and 2005. Moreover, the data collected between 2001 and 2010, revealed an average of 17(SD 6.9) with variation in the incidence between each years. The human rabies incidence in 2009 was 0.89 death / million population.

Approximately, 40% of the inhabitants was under 15 years of age. Moreover, the disease was reported in rural areas than urban areas. The male reported high rabies incidence (8 cases) than female (1 case) (Horton *et al.*, 2013). Bite of dog may lead to a series of wounds, including laceration, deep-seated open injuries, perforated wounds, crush wounds shredding away one of a body part. Dog bites are considered crushing wounds due to their exceptionally strong jaws and rounded teeth. Historically, animals teeth are made to kill and tear flesh therefore can cause a lot of damage. Adult dogs can do 200–450 psi (pounds per square inch) of pressure with their jaws. Damage to muscle, tendons, vessels, nerves and even bone are all possible concerns with any dog bite. The trained dog such as police

dog can related with more severe biting power that vary from civilian untrained dog bites. Hutson *et al.*, (1997) reported a 705 dog bites inflicted at prison amber patients in Los Angeles between years 1988-1995 with 19.3% complications. The percentages were 4, 7, 1.9 and 5% for bone fractures and cortical penetration, vascular wounds, nerve injury, and infections respectively in addition to tendon injuries and joint interruption. Moreover, 20 to 35 person, many of them children killed due to dog attacks every year in United States (Hutson *et al.*, 1997). The dog bites can cause three types of soft tissue injuries: Punctures, Lacerations and Avulsions with or without real tissue lack. A classic dog bite results in mixture of puncture-type injuries with neighboring rupturing of tissue that called as the (Hole and Tear) effect (Panagiotis, 2009). Smash injuries were also seen in different degree in dog bites due to bite dynamics. The existence of a confined spot of entry, poor drainage and injection of organisms to depth of the tissue lead to develop the clinical implications in dog bite. These factors generate the suitable environment for proliferation of anaerobic bacteria. Wounds result from dog bite are much vary from other kinds of tissue ruptures and lacerations. Dog like to shake their head during attack and bite, leading to rupturing wounds and loss of flesh and neighboring tissues. A dog bites frequently leave severe and permanent scar tissue. Highly visible areas of wounds were seen on the face, lips ears, nose, neck and trunk of dog bite children. These wounds need multiple, long term plastic surgery strategy and extensive care to reduce or remove the scar (Speirs *et al.*, 2015).

Materials & Methods

This retrospective study was conducted in Al Muthanna / Samaw hospital / Iraq. The current study approved from research committee in the college of veterinary medicine / Al Muthanna University. Dog bites data were reviewed from hospital records for 11 months that extended between December 2015 to January 2016.

The medical records also were reviewed for demographical parameters including: the sex and the age of the victim, injuries features, ownership status of the dog (unknown / known to the victim/stray dog), site and location of the bite on the body (upper extremity, lower extremity, face, trunk, the time from wound to presentation to the clinic and the management and treatment received (antibiotics, surgical intervention, treatment). The time and steps of healing of one patient with his own dog bite on its upper extremity followed up and this patient was signed the consent form.

Statistical analysis

To describe the study population, the descriptive statistics was calculated using frequencies and percentages and compared patient characteristics by W2 and Fisher's exact tests where appropriate. All statistical tests were considered to be significant at a two-sided $p < 0.001$. All analyses were performed using SAS version 2012.

Results

During the study period (from January –November / 2016) there were 176 of different age group emergency department visits for dog bites (Table.5).

Table. 5: Shows the number of dog bites incidence according to months and patient demographic factor.

| Months | Victims Age groups | | | | | | | | | | Total Male | Total Female | Total |
|--------------|--------------------|----------|-----------|----------|------------|----------|-------------|-----------|--------------------|-----------|------------|--------------|------------|
| | Less than 1 year | | 1-4 years | | 5-14 years | | 15-45 years | | More than 45 years | | | | |
| | M | F | M | F | M | F | M | F | M | F | | | |
| January | 0 | 0 | 0 | 0 | 7 | 2 | 11 | 3 | 1 | 1 | 19 | 6 | 25 |
| February | 0 | 0 | 0 | 0 | 3 | 0 | 5 | 1 | 0 | 0 | 8 | 1 | 9 |
| March | 0 | 0 | 0 | 0 | 1 | 0 | 4 | 4 | 3 | 1 | 8 | 5 | 13 |
| April | 0 | 0 | 0 | 1 | 5 | 0 | 7 | 1 | 1 | 1 | 13 | 3 | 16 |
| May | 0 | 0 | 0 | 0 | 6 | 0 | 9 | 0 | 2 | 2 | 17 | 2 | 19 |
| June | 0 | 0 | 0 | 0 | 4 | 1 | 4 | 4 | 3 | 6 | 11 | 11 | 22 |
| July | 0 | 0 | 0 | 1★ | 8 | 0 | 4 | 2 | 1 | 0 | 13 | 3 | 16 |
| August | 0 | 0 | 0 | 0 | 1 | 1 | 7 | 2 | 0 | 0 | 8 | 3 | 11 |
| September | 0 | 0 | 1 | 0 | 6 | 1 | 3 | 1 | 0 | | 10 | 2 | 12 |
| October | 0 | 0 | 1 | 0 | 7 | 0 | 4 | 2 | 4 | 1 | 16 | 3 | 19 |
| November | 0 | 0 | 0 | 1 | 3 | 0 | 9 | 1 | 0 | 0 | 12 | 2 | 14 |
| Total | 0 | 0 | 2 | 3 | 52 | 5 | 67 | 21 | 14 | 12 | 135 | 41 | 176 |

★ This patient developed signs of Rabies

The incidence of dog bites was varied between different months of the study, among 176 dog bites, there were 25 (19 M+ 6 F), 9 (8 M +1 F), 13(8M +5 F), 16 (13M+3 F), 19(17M+2F), 22 (11M+11F), 16(13M+3F), 11(8M+3F), 12(10M+2F), 19 (16M+3F) and 14(12M+2F) that occurred in January, February, March. , April, May, June, July, August, September, October and November respectively (Figure .1).

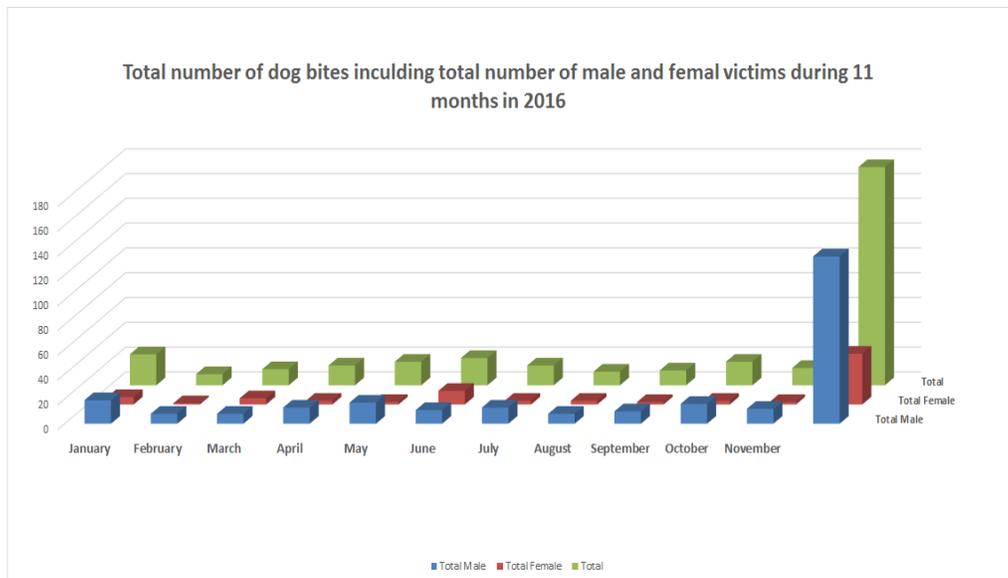


Figure.1: Shows the number of dog bites in each month of the study period .

Among the 176 person with dog bites, there were 41 female and 135 male with percentages of 23.295% and 76.704% respectively (Figure.2).

**Percentages of dog bites incidence
distributes according to sex (Male and
female)**

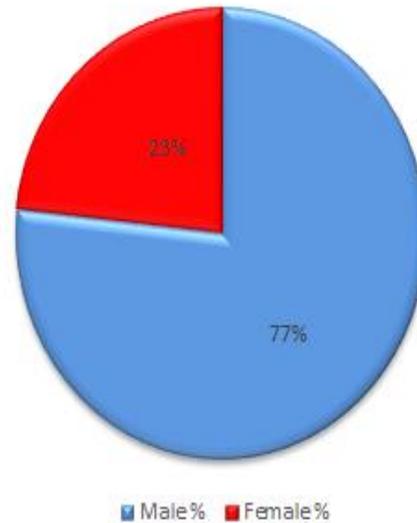


Figure. 2: Shows the incidence of dog bites distributed according to the sex.

The incidence of dog bites was varied between the victims age group, there were 0 (0%), 5(3%), 57 (32%), 88 (50%) and 26 (15%) for less than one year, 1-4 years, 5-14 years, 15-45 years and more than 45 years respectively (Figure.3 A&B).

The statistical analysis for prevalence according age group revealed (P Value=0.336 Chi-Sq 0.259) , (P Value=0.001 significance, Chi-Sq 0.028), (P Value=0.007 significance, Chi-Sq 0.066), (P Value=0.0723, Chi-Sq 0.48) and (P Value=0.078, Chi-Sq 0.067) for 1-4 years , 5-14 years , 15-45 years, and more than 45 years respectively.

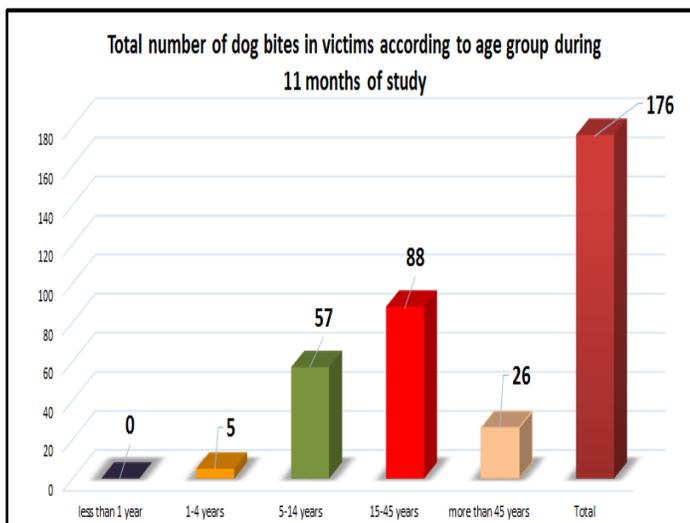


Figure 3 A: shows the percentages of incidence according to victims age group during 11 months.

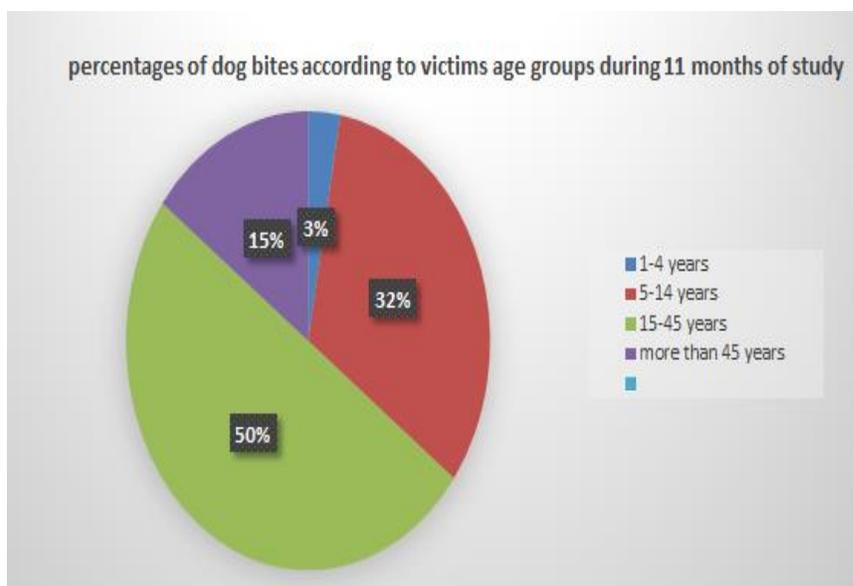


Figure.3 B: The Pie chart shows the percentages of incidence according to victim's age group during 11 months.

The total population of Al Muthanna governorate was 775X1000 according to total estimation of Iraq (April 2009 IMF estimate). The total incidence rate of dog bites in Al Muthanna governorate/ 100.000 person was 22.709 % for the total population (Figure.4).

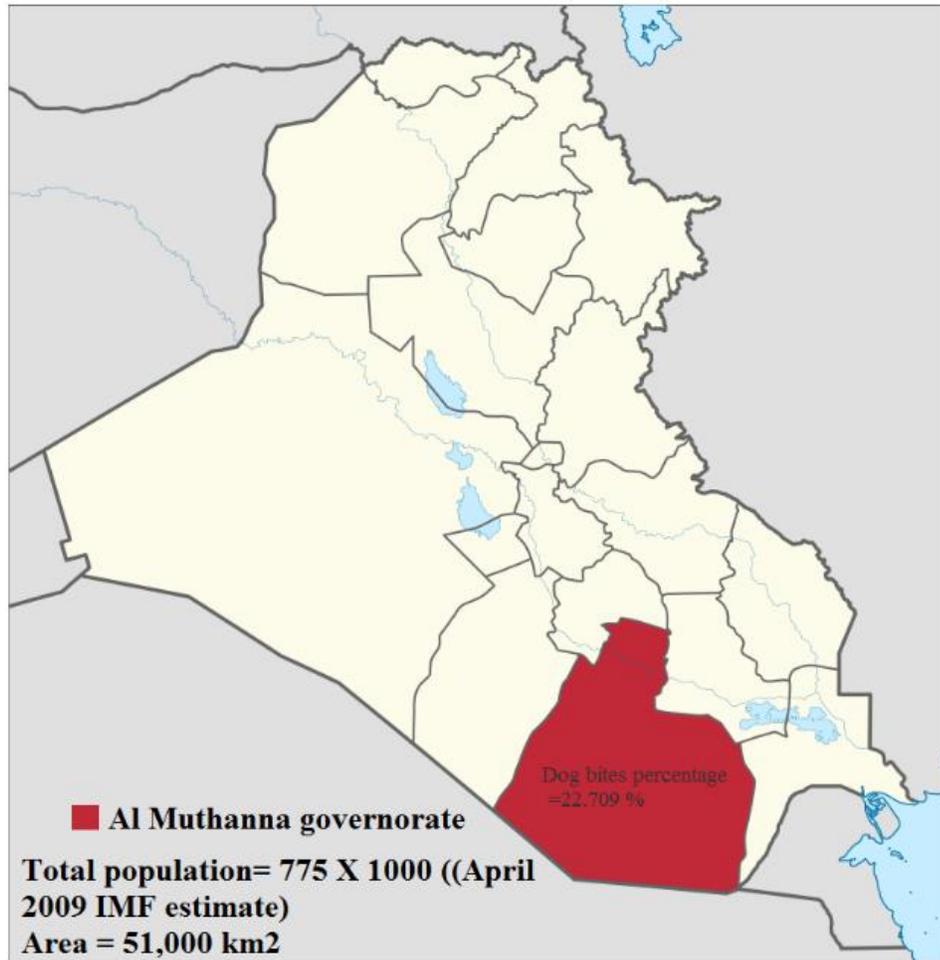


Figure.4: Shows the total incidence rate of dog bites in Al Muthanna governorate/ 100.000 person for the total population

Among 176 victims, only one female patients within age group (1-4 years) developed clinical signs of Rabies and died. This dog bite happened at July (Table 1) with percentage of rabies incidence 0.568 for the total dog bites. Moreover, the percentage of rabies for total population of Al Muthanna governorate was 0.129/ 100.000. All victims revealed multiple location of dog bites and the majorities were occurred in the upper extremities, lower extremities facial, trunk and genital area. All victims were hospitalized and treated with tetanus, rabies prophylaxis and antibiotics administrated for all victims.

Among 176 victims one patient was bitten from his own dog. The bite located on the right arm. The time and steps of healing process was followed up in this patient. The first presentation of the patient revealed 3 different sized injuries on the right arm 2 injuries was small and shallow and the third one was deep and tringle in shape (Figure 5). The patient was suffered from severe pain and unable to move his hand and he thought that there was a damage of the nerve.

Three days later, the wound showed signs of inflammation and accumulation of pus. One week later, with systemic antibiotic administration the pus disappeared and wound

minimized in size (Figure. 6). The wound minimized and scar tissue formation occurred after 2 weeks. Three weeks later the scar dropped and left a centrally depressed red area (Figure.7).



Figure. 5: Shows injuries at the first presentation after the dog bites. The Injuries was on different locations of the victim right upper extremity. A & B: small injuries. C . Large deep wound appeared as triangle shape surrounded by hyperemic zone and full thickness rupture of the skin

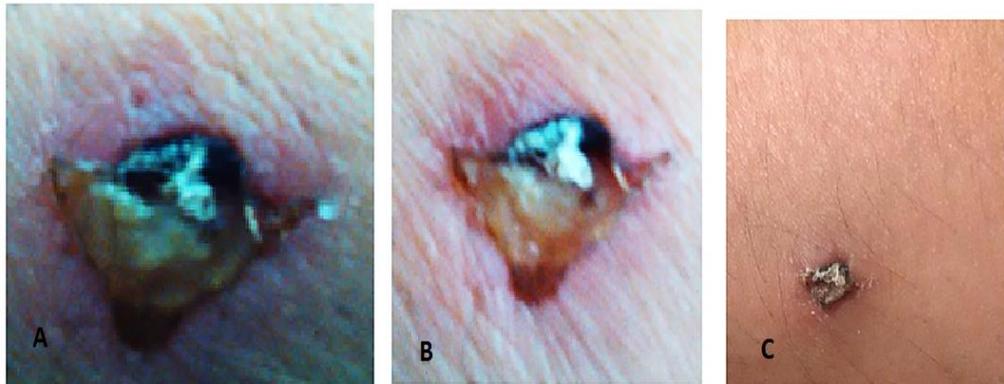


Figure. 6: Shows deep wound 3 days after the dog bites. The wound revealed accumulation of pus in A& B. C: Show the progress of healing and absence of the pus after antibiotic treatment with minimization the size of the wound after one week.

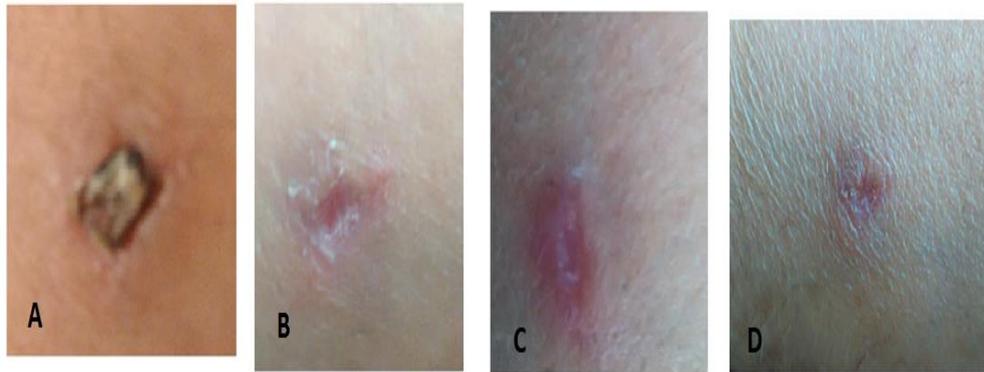


Figure. 7: Shows healing steps of deep wound weeks after dog bites. The wound A: Reveals minimizing and scar tissue formation after 2 weeks. B & C: Reveal the falling down of the scar leaving depressed red area, 3 weeks after bite. D: Reveals the small scar formation that appeared as depressed centrally. AA

Discussion

In this study, the incidence of dog bites was reported in Al Muthanna governorate. Al Muthanna governorate is the second largest governorate in Iraq, called after the 7th-century Arab general Al-Muthanna Ibn Haritha. It is one of the Middle Euphrates governorate and extends over 51,000 km² and total population of 775X1000 according to total population estimation of Iraq (April 2009 IMF estimate). It is located in the south of the country, bordering Saudi Arabia. It is bordered Najaf and Diwaniya governorates to the north and Dhi Qar on the east. Samawah is very related to the Uruk the ancient Sumerian-Babylonian city, probably the origin of the name Iraq.

Dog bites are recognized as a dangerous health problem because of its high incidence around the world (Centers for Disease Control and Prevention, 2001; Shipkov *et al.*, 2013; Quinlan & Sacks, 1999; Schalamon *et al.*, 2006; Voelker, 1997; Nygaard & Dahlin, 2011). Among domestic animal bites, 80-90% were dog bites with 2 % of these bites need admission to hospital (Benson *et al.*, 2006). Kids and teenagers are probably more than adults to maintain dog bites with plenty effect of their arm and upper limbs (Kahn *et al.*, 2003). In all dog bites, there were increasing in the risk of acute infection and result due to improper and delay in the treatment of bite-accompanied injuries (Esposito *et al.*, 2013).

The results of the current study revealed that the dog bites register in Al Muthanna governorate during all months of 2016. The total number of dog bites during 11 months of the study represented 176 persons with variation in the number of cases between each month. The results of this study report that the total incidence percentages / 100.000 person of dog bites in Al Muthanna governorate was 22.709 % for the total population. This result is incompatible with previous study that reported the dog bites in several Iraqi governorates (Horton *et al.*, 2013). The total number of dog bites in the current study was 176 in compare with previous study that reported higher incidence number 845, 4610, 1050, 713, 512, 1430, 2400 and 722 in Salah-Eldin, Baghdad, Babil, Thiqr, Missan, Wasit, Basra, and Diwania respectively in 2007 (Horton *et al.*, 2013). However, the results of the current study are in agreement with the results of previous studies in regard to the higher incidence

of dog bites in kids and teenager and in male than female 1:3.29 (Male 76.704% and female 23.295%). The dog bites occurred in higher percentages in the age group 15-45 years with total number 88 (50%) followed by age groups 5-14 years, more than 45 years , 1-4 years and less than 1 year with total number 57 (32%), 26 (15%), 5(3%) and 0 (0%) respectively. The previous study in Iraq also reported higher Male, female ratio 9.5 to 1 , in 2007 , while the more age affected between 2.5 year and 24 years (Horton *et al.*, 2013). The result of the current study also reported one case of rabies in female patients within age group (1-4 years). This female developed clinical signs of Rabies and died. The total incidence rate of dog bites in Al Muthanna governorate / 100.000 person was 22.709 % using estimate of 775 X 1000 total Al Muthanna population. Moreover, the current study revealed 0.568% human rabies incidence for the total dog bites. The results of the current study is incompatible with previous report (World Bank, 2008) that reported the incidence of human rabies in Iraq during 2009 with estimated death rate for 0.89 /1.000.000 according to a population estimate of 30 million.

While this result is higher than the rabies rate in dog bites 0.13% / 100.000 that reported previously in 2007 in other governorate in Iraq (Horton *et al.*, 2013).

The data of the current study revealed multiple location of dog bites in all victims with majorities of injuries that occurred in the upper extremities, lower extremities facial, trunk and genital area. This results are in agreement with previous studies of (Joshua *et al.*, 2015) who reported that 96% of patients suffered from injuries to single parts of their bodies. However, 46.6% on face/ trunk and 35.5% on the lower limbs. This results also similar to Schalamon *et al.*, (2006), who reported 357 dog bites in Austria. The reviewed data regarding the patients of the current study approved that all victims were hospitalized and treated with tetanus, rabies prophylaxis dose, in addition, to antibiotics administrated for all victims. These treatment and management processes are compatible with procedures mentioned in most literatures that deal with the dog bites treatment plan (Nygaard & Dahlin, 2011; Kahn *et al.*, 2003).

The follow up observation of the time and steps of healing process of dog bites in one patient reported different sized injuries on the right arm. Some of these injuries were small and shallow while the other was deep and tringle in shape. The healing process long for three weeks and revealed different gross pathological changes and eventually minimizing in the size and closing of the wound by the scar tissue that dropped and left a centrally depressed red area three weeks after bite.

All these changes are similar to dog bites healing process reported previously by other researcher that reported the scar formation in the majorities of dog bite and need further plastic surgery plan (Speirs *et al.*, 2015);Panagiotis, 2009; Hutson *et al.*, 1997).

In conclusion this study approved the incidence of dog bites in Al Muthanna governorate. The higher incidence percentages of dog bites occur between the patient of age group 15-45 year and followed by 5-14 years. Moreover, the incidence rate of dog bites was higher in male than female. The study approved the incidence of rabies in one case of the total dog bites. The Authors recommended another future retrospective study that reviewed more years to determine the actual situation of the dog bites that act as a serious health problem.

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