

An Eight-Year Review of the Frequency and Outcome of Dog Bite and Clinical Rabies in a Teaching Hospital in North Central Nigeria

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Abstract

Introduction: Rabies is a neglected tropical disease that is highly fatal and yet it is under-reported in the developing countries like Nigeria. The domestic dog is the primary reservoir host as well as the most important source of infection usually conveyed by saliva through bites. **Aim:** This study sought to determine the frequency and outcome of dog bite injury and clinical rabies presented to the Accident and Emergency unit of Benue State University Teaching Hospital Makurdi, Benue State, Nigeria. **Methods:** This retrospective hospital-based study reviewed the medical records of all patients with dog bite who presented over an eight-year period from August 2014 to July 2022. Rabies virus infection was diagnosed on clinical basis. A structured proforma was used to extract relevant information and data was analysed using the statistical package for social sciences (SPSS) version 21. **Result:** Mean and median age was 27.03 ± 10.98 and 29 years respectively, range of 2 - 47 years and 11 (73.3%) were males. There were 15 cases of dog bite out of 17,187 patients making frequency of 1.14 per 1000 persons constituting 0.09% or about 2 cases yearly. Seven (46.7%) of this total number had clinical rabies infection with 7 (100.0%) mortality. All 7 (100.0%) with clinical rabies had a furious (encephalitic) form. Rabies immunoglobulin was prescribed in 8 (53.3%), 6 (40.0%) received them while 13 (86.7%) received post-exposure rabies vaccine. **Conclusion:** Dog bite is an uncommon reason for Accident and Emergency visit in our facility with male preponderance. However, about 46.7% of the dog bite victims developed clinical symptoms suggestive of furious (encephalitic) form of rabies with 100.0% fatality.

Keywords

Dog Bite, Rabies Virus Infection, Makurdi, North Central, Nigeria

1. Introduction

Dog bite injury in humans is a neglected global public health problem which is underreported in the developing countries like Nigeria [1] [2]. Bites by unvaccinated dogs when untreated can result in rabies. Rabies is a highly fatal viral zoonotic infection that results in acute neurological disease. This is caused by a rhabdovirus genotype a single stranded RNA virus of the Lyssa virus genus that infects the central nervous system and salivary glands of a wide range of mammals [3]. The domestic dog is the principal reservoir host as well as the most important source of infection for people especially in Africa [4]. The infection is usually conveyed by saliva through bites, licks or abrasions or on intact mucous membrane [5]. There has been report of rabies transmission via transplanted neurologic tissues (corneas) and solid organs [6] [7] [8]. The incubation period of rabies is about 1 - 3 months; this may be shortened to a few days if inoculation occurs in the head and neck region [9]. The virus enters the body binds to the nicotinic acetylcholine receptor on the post synaptic membrane at the neuromuscular junction and spread centripetally to the central nervous system and spinal cord.

It can present in two phases, namely prodromal phase and the acute neurologic phase [10]. The prodromal phase is characterized by fever, headache, nausea, vomiting, paraesthesiae, pain or pruritus at site of bite; usually starts most times after wound has healed. The acute neurologic period can manifest as encephalitic or furious form and the paralytic or dumb form. The furious form accounts for 70% - 80% of cases and presents as fever, convulsions, hallucinations, confusion, agitation, combativeness, hyper salivation, goose flesh, cardiac arrhythmia or priapism. Brain stem involvement will cause hydrophobia and aerophobia which is due to involuntary painful contraction of the diaphragm, accessory respiratory muscles, laryngeal and pharyngeal muscles on swallowing water and with draft of air. Death occurs within days. The paralytic phase presents as paralysis of muscles starting from the site of exposure and progressing to quadriplegia. They tend to live longer than encephalitic patients but could die from multiple organ failure [10].

Despite the ability to control and prevent the disease, current mortality estimates almost certainly under-represent the true incidence of human rabies deaths [1]. However, the true burden of the disease remains undefined in most developing countries because of lack of systematic surveillance, lack of laboratory confirmation and unreported clinical cases. Human rabies is a preventable disease necessitating the global call for action against rabies through a collaborative move by World Health Organization (WHO), the Food and Agriculture Organization (FAO), the World Organization Animal Health (OIE) and the Global Alliance for Rabies Control (GARC) to target a zero human death from dog-mediated rabies by 2030 [11]. Proven measures for rabies prevention and control will include dog vaccination, provision of post-exposure prophylaxis (PEP) to exposed persons. Others are enhanced laboratory-based surveillance, pre-exposure vaccination of at-risk groups as well as educational outreach to

improve community knowledge and practices [12].

A recent scoping review of rabies virus in Nigeria had put the prevalence of rabies as 6% in the south-south region, between 5% - 9% in the south-east, 2% - 11% in the south-west, 4% - 50% in the north-west, 5% - 17% in the north-central and 2% - 44% in the north-east [13]. Cases of dog bite in Nigeria present to either veterinary clinics or hospitals for reporting and treatment and mortality recorded in presumptive or confirmed diagnosis of rabies was 80% [13]. This study sought to determine the frequency and outcome of dog bite injury and clinical rabies presenting to the Accident and Emergency (A&E) unit of Benue State University Teaching Hospital (BSUTH) Makurdi, Benue state Nigeria. This review of hospital based epidemiological data on dog bite and rabies is essential in the study area particularly as well as the entire country in order to help determine the impacts of the disease, evaluate the current treatment and preventive measures and elucidate future interventional strategies.

2. Materials and Methods

2.1. Study Design

This is a descriptive retrospective hospital-based study.

2.2. Study Site

The study was carried out at the Accident and Emergency unit of Benue State University Teaching Hospital Makurdi, North central Nigeria.

2.3. Ethical Consideration

Ethical approval was obtained from the Health Research Ethical Committee of the Benue State University Teaching Hospital, Makurdi Benue State for the study. Strict confidentiality was maintained in the handling of patients' medical records for data extraction.

2.4. Methods

We reviewed the admission and discharge books at the accident and emergency (A & E) unit of the hospital to identify records of all cases of dog bite reported over an eight-year period from August 2014 to July 2022. The medical records of all patients with dog bite injury treated in the A & E unit during the period under review were retrieved. A structured proforma was used to extract demographic information such as age, sex, marital status and level of education. Clinical information obtained included time interval between dog bite and presentation, site of bite, immunization status of dog and presenting symptoms and outcome from each hospital file. Also, phone calls were made to relatives of patients who had been discharged against medical advice to determine their outcome. Confirmatory laboratory investigation to diagnose rabies was not available in this study as our patients were diagnosed clinically when someone who was suspected to have had contact with a rabid dog develops one or more of the follow-

ing symptoms: headache, neck pain, nausea, fever, hydrophobia, anxiety, agitation, hallucination, abnormal tingling sensations or pain at the wound site, etc. from the records [10]. Also, we could not conduct autopsy for all cases that died.

2.5. Statistical Analysis

Extracted data were both coded and analysed using the statistical package for social sciences (SPSS) software (version 21; SPSS, Chicago, IL, USA). Descriptive statistics were used to compute range and median for quantitative variables as well as frequencies and percentages. Results were expressed in tables and appropriate chart. Spearman's correlation analysis was used to determine the relationship between dog vaccination status and ownership as well as rabies infection. A p-value of less than 0.05 was used to determine statistical significance.

3. Result

3.1. Socio-Demographic Characteristics

The mean and median age was 27.03 ± 10.98 and 29 years respectively while their age ranged between 2 - 47 years with majority, 6 (40.0%) in the 21 - 30 years age group. Majority of the patients were males, 11 (73.3%) with male: female ratio of 2.75:1. Equal number of the patients, 6 (40.0%) each had primary and tertiary educational level respectively with more proportion of 8 (53.3%) of them single (Table 1).

Table 1. Socio-demographic characteristics of participants.

Variable	Frequency	Percentage
Age Group (Years)		
<20	4	26.7
21 - 30	6	40.0
31 - 40	4	26.8
>40	1	6.9
Gender		
Male	11	73.3
Female	4	26.7
Educational Level		
None	1	6.7
Primary	6	40.0
Secondary	2	13.3
Tertiary	6	40.0
Marital Status		
Married	7	46.7
Single	8	53.3

3.2. Frequency

This study found 15 cases of dog bite out of 17,187 patients who presented at the A & E unit of BSUTH, Makurdi Benue state over an eight-year period making approximately 1.14 per 1000 persons or about 2 cases yearly. This constituted about 0.09% of the total patient attendance at the A & E unit during the study period. Out of the 15 patients with dog bite injury, 7 (46.7%) of them had clinical rabies infection as shown in **Figure 1** below and all of them, 7 (100.0%) died from the illness.

3.3. Clinical Characteristics

All the patients, 7 (100.0%) with clinical rabies had a furious (encephalitic) form. Common presenting symptoms documented in descending order were hallucination 5 (71.4%), agitation 4 (57.1%), hydrophobia 4 (57.1%), respiratory paralysis 1 (14.3%) and paraesthesiae 1 (14.3%) as in **Figure 2**. Majority of the victims presented within 24 hours of the bite, 6 (40.0%). Others were 1 - 7 days 3 (20.0%), 8 - 28 days 1 (6.7%) and after 28 days 5 (33.3%) as in **Figure 3** below. Regarding the ownership of the dogs that bite the victims, 7 (46.7%) were stray dogs; 6 (40.0%) by neighbours dogs while 2 (13.3%) were by own dog. Majority of the dog bites were unprovoked 13 (86.7%) with more proportion of them vaccinated 6 (40.0%). Most victims were bitten on their lower limbs 8 (53.3%) with majority occurring during the rainy season 11 (73.3%). Only 8 (53.3%) of the dog bite victims who incidentally did not develop clinical rabies symptom survived as in **Table 2** below. There is a significant and negative correlation between dog vaccination status and their ownership as well as development of clinical rabies infection ($r = -0.647$; $p = 0.009$ and $r = -0.559$; $p = 0.030$) respectively as in **Table 3** below. Concerning treatment received following dog bite, majority of 10 (66.7%) received no treatment at all on presentation either because the wound was already healed or was very minimal. Among these dog bite victims, attending clinicians prescribed rabies immunoglobulin in 8 (53.3%) while only 6 (40.0%) received them. Majority of the victims, 13 (86.7%) were

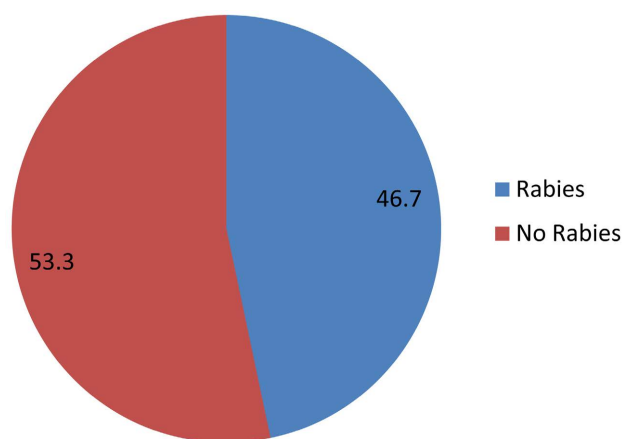


Figure 1. Frequency of clinical rabies following dog bite.

Table 2. Characteristics of dogs and dog bite injury.

Variable	Frequency	Percentage
Ownership of Dog		
Stray dog	7	46.7
Own dog	2	13.3
Neighbour's dog	6	40.0
Dog vaccination status		
Vaccinated	6	40.0
Unvaccinated	4	26.7
Unknown	5	33.3
Site of bite		
Head and neck	0	0.0
Upper limb	7	46.7
Trunk and buttocks	0	0.0
Lower limb	8	53.3
Month of bite		
Rainy season	11	73.3
Dry season	4	26.7
Bite circumstance		
Provoked	2	13.3
Unprovoked	13	86.7
Outcome of dog bite		
Death	7	46.7
Survived	8	53.3

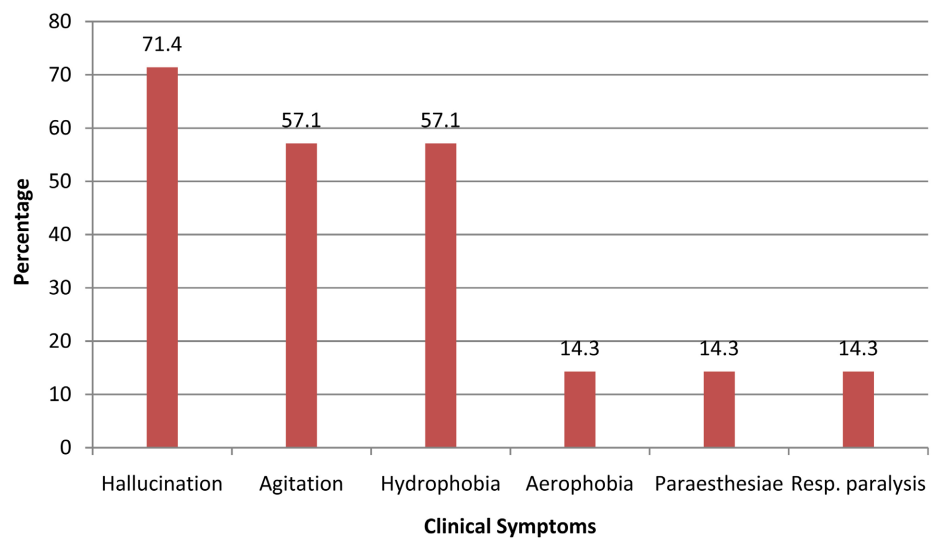


Figure 2. Presenting symptoms by patients with rabies. *Multiple responses.

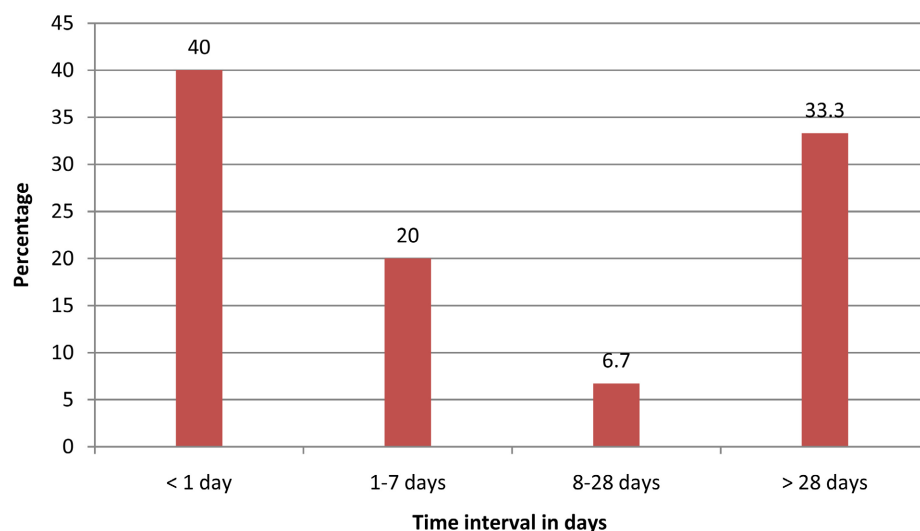


Figure 3. Time interval between dog bite and presentation of victims.

commenced on post exposure rabies vaccine. Other details regarding wound care and medications received are shown in **Table 4** below.

4. Discussion

The present study found dog bite injury to be an uncommon reason for presentation in our A & E unit as 15 cases out of 17,187 consultations were seen over an 8-year period. This constituted 0.09% or 1.14 persons per 1000 and approximately 2 cases of dog bite annually. Our finding is consistent with previous reports in Nigeria that showed that dog bite injury is a rare reason why people seek emergency medical care [14] [15] [16]. Also, the current incidence of 0.09% is lower than the 0.3% reported by Abubakar *et al.* [15]. While another study by Ogundare *et al.* [16] among children equally found a higher incidence of 0.89%. The lower frequency in our study may not be unconnected with the presence of Federal Medical Centre Makurdi as an alternative option to seek emergency medical care in the area. The frequency of rabies in this study among patients presenting with dog bite injury was 7 (46.7%) which was in agreement with 40.2% found in a study in Burkina Faso [17]. However, our incidence was higher than two previous researches conducted in Nigeria which found 1.4% and 7.1% by Omoke *et al.*, and Ogundare *et al.* respectively [14] [16]. The higher incidence of rabies found in our study may be attributable to the presence of a Veterinary Teaching Hospital within the area from where patients who presented to report the incidence of dog bite were immediately referred to BSUTH.

The fatality rate of clinically diagnosed rabies virus infection in this study was 100.0% as all the 7 patients that presented with symptoms suggestive of the illness died. Similar trend has been documented by other investigators in Nigeria and Ghana [16] [18]. It has been shown that once clinical symptoms appear, rabies is virtually 100.0% fatal [9]. Reports have shown that more than 59,000 people die of rabies worldwide every year, with 99% of them in African and

Table 3. Correlation of dog vaccination status with ownership and clinical rabies infection.

Variable	r	p-value
Dog ownership	-0.647	0.009
Clinical rabies infection	-0.559	0.030

Table 4. Treatment received by dog bite victims.

Variable	Frequency	Percentage
Wound care		
None	10	66.7
Saline irrigation	3	20.0
Antiseptic cleaning	1	6.7
Dressing	1	6.7
Medications Received		
Antibiotics + Analgesics	7	46.7
IV fluids + Antibiotics + Analgesics	1	6.7
Sedatives + IV fluids + Antibiotics + Analgesics	6	40.0
None	1	6.7
Rabies immunoglobulin prescribed		
Yes	8	53.3
No	7	46.7
Rabies immunoglobulin received		
Yes	6	40.0
No	9	60.0
Post-exposure rabies vaccine		
Yes	13	86.7
No	2	13.3

IV = Intravenous.

Asian countries alone where dog rabies is endemic [1] [19]. In Africa, rabies virus infection was said to be responsible for an estimated 21,000 - 25,000 deaths annually [20] [21]. The actual frequency of dog bite, rabies infection and mortality rate from our facility might be much higher than this figure reported in the current study due to the problem of ignorance, poverty, seeking alternative care thereby not presenting to veterinary clinic or health facility. There is also the challenge of under-reporting of cases, poor surveillance and lack of effective collaboration between the veterinary clinics and health care facilities [1]. Therefore a joint contact tracing by veterinary and public health service using the One

Health approach as advocated by WHO is encouraged to identify additional suspected rabid animals and human bite victims, with the goal of applying preventive measures accordingly [22].

This study revealed a mean and median age of 27 and 29 years respectively while their age ranged between 2 - 47 years and about 40.0% of them were within the 21 - 30 years age group. This finding appears to be in conflict with several previous reports that showed peak incidence of dog bite and rabies to be between 1 - 14 years age group [14] [15] [16] [22] [23]. This has been attributed to the children's immaturity and inability to interpret and react in rapidly changing interactions while playing with the dogs. They are more likely to provoke the dogs and less likely to defend themselves thereby sustaining multiple injuries [14] [15]. Education on dog behaviour and bite prevention for both children and adults is an essential extension of a rabies vaccination programme and can decrease both the incidence of human rabies and the financial burden of treating dog bite victims. There is the need for increased awareness of rabies prevention and control in communities especially with emphasis on responsible pet ownership, how to prevent dog bites, and the necessity for immediate hospital care after a bite.

Our study revealed that majority, 73.3% of the victims of dog bite were males with male: female ratio of 2.75:1. This pattern of male preponderance has been documented in previous studies [15] [16] [18] [23] [24]. The tendency of males to be victims of dog bite injury may not be unconnected with their adventurous and daring nature as well as their occupation that may put them at risk. The current study showed that all the patients, 7 (100.0%) with clinical rabies had a furious (encephalitic) form. Furious rabies could result in signs of hyperactivity, excitable behaviour, hydrophobia (fear of water) and sometimes aerophobia (fear of drafts or of fresh air). Ultimately, death follows a few days later due to cardio-respiratory arrest [22]. Presenting symptoms found in our cohorts included: hallucination 71.4%, agitation 57.1%, hydrophobia 57.1%, respiratory paralysis 4.3% and paraesthesia 14.3%. There is a high possibility to misdiagnose patients with rabies virus infection as a result of prominent neuro-psychiatric manifestations, especially where clinical information regarding contact with dog was not volunteered. Such patients could be thought to have meningitis, meningo-encephalitis, encephalitis or even mental illness.

This study has also shown that majority of the victim was bitten by stray dogs, 46.7% with about 40.0% of the dogs vaccinated which aligns with previous works by Omoke *et al.* and Abubakar *et al.* that reported 37.8% and 30.8% vaccination status respectively [14] [15]. In contrast to ours, a study in the same area by Audu *et al.* reported 18.0% of up-to-date vaccination in dogs [25]. The lower dog vaccination status in their study may be due to the fact that the investigators insisted on sighting valid dog vaccination card as criteria for current vaccination while ours was based on reported information from the patients or their caregivers. It is noteworthy that vaccinating dogs is the most cost-effective strategy for preventing rabies in people. This is because dog vaccination re-

duces deaths attributable to dog-mediated rabies and the need for PEP as a part of dog bite patient care [22].

About 40.0% of dog bite victim presented to the hospital within 24 hours of the incidence which was lower than 87.7% and 82.0% respectively documented by previous researchers [15] [16]. Evidence had shown that starting PEP treatment immediately after dog bite can effectively prevent rabies virus entry into the central nervous system and subsequently the onset of symptoms and death [22]. Hence health education and public enlightenment is needed to enhance early presentation so as to reduce mortality. PEP consists of extensive washing and local treatment of the bite wound or scratch as soon as possible after a suspected dog bite; a course of potent and effective rabies vaccine that meets WHO standards; and the administration of rabies immunoglobulin (RIG), if indicated [22].

About 53.3% of our patients had RIG prescribed for them at presentation out of which 40.0% of them received it which was higher than 18.5% and 8.6% respectively reported by Abubakar *et al.* in Zaria [15]. In our cohorts 86.7% received PEP vaccine which was comparable to 87.7% in a previous research [15]. Administration of PEP depends on the type of contact with the suspected rabid animal. For category I exposure which implies touching or feeding animals, licks on intact skin there is no PEP required. In category II in which there could be nibbling of uncovered skin, minor scratches or abrasions without bleeding, immediate vaccination should be administered. For category III in which there could be single or multiple transdermal bites or scratches, contamination of mucous membrane with saliva from licks, licks on broken skin, exposures to dogs or bats, immediate vaccination and administration of HRIG are recommended [26]. Passive immunization with RIG provides protection for 1 - 2 weeks until the vaccine elicits protective antibody [10]. The RIG is given as 20 IU/kg infiltrated as much as feasible around and under the bite wound; if any left-over it is given intramuscular (IM) at the gluteus. Patients without prior rabies vaccination or of unknown status should be given rabies vaccine and RIG as follows: rabies vaccine IM in the deltoid region 1 mL on days 0, 3, 7, and 14 but for immunocompromised persons, an additional dose of 1 mL IM in the deltoid region on day 28 should be administered [10].

5. Conclusion

This study revealed that dog bite is an uncommon reason for Accident and Emergency visit in our facility with male preponderance. However, about 46.7% of the dog bite victims developed clinical symptoms suggestive of furious (encephalitic) form of rabies infection with 100.0% fatality.

6. Limitations

This retrospective hospital based review is essential in educating clinicians on the management of dog bite and rabies aside providing epidemiological data on

the impact of the illness. Firstly, due to the fact that hospital records were utilized there is possibility of missing or incomplete data. Secondly, diagnosis of rabies was clinical as there was no laboratory confirmation due to non-availability of such facility within the study area.

7. Recommendations

1) In order to achieve the “Zero human deaths” from dog-mediated rabies by 2030 there is the need to enhance the “One Health” collaboration between veterinary and medical health care services by ensuring prompt notification of cases and immediate referral.

2) There is the need for increased awareness creation on rabies prevention and control in communities especially with emphasis on ensuring up-to-date vaccination of dogs, how to prevent dog bites, and the necessity for early presentation for hospital care immediately after a bite.

3) There is also the need to educate clinicians on the current management guidelines for dog bite and rabies infection and to develop protocols for emergency unit care.

Conflicts of Interest

The authors declare no conflicts of interest regarding the publication of this paper.

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