Annals of Agricultural and Environmental Medicine 2015, Vol 22, No 1, 76–79
www.aaem.pl

ORIGINAL ARTICLE

Epidemiology of animal bites and other potential rabies exposures and anti-rabies vaccine utilization in a rural area in Southern Ethiopia

José M. Ramos[1,2], Napoleón Melendez[1], Francisco Reyes[2], Ganamo Gudiso[2], Dejene Biru[2], Gamadi Fano[2], Gulelat Aberra[2], Dalu Tessema[2], Abraham Tesfamariam[2], Seble Balcha[2], Félix Gutiérrez[1,3]

[1] *Infectious Diseases Unit, Hospital General Universitario de Elche, Alicante, Spain*
[2] *Gambo General Rural Hospital, Shashemane, Ethiopia*
[3] *Department of Clinical Medicine, Faculty of Medicine, University Miguel Hernández, Alicante, Spain*

Ramos JM, Melendez N, Reyes F, Gudiso G, Biru D, Fano G, Aberra G, Tessema D, Tesfamariam A, Balcha S, Gutiérrez F. Epidemiology of animal bites and other potential rabies exposures and anti-rabies vaccine utilization in a rural area in Southern Ethiopia. Ann Agric Environ Med. 2015; 22(1): 76–79. doi: 10.5604/12321966.1141372

Abstract

The presented report describes the epidemiology of potential rabies exposures and examines the utilization of anti-rabies vaccine in a rural area of Ethiopia during a period of 43 months. A total of 683 persons (51.1% females, 73% children) with animal- related bites were included in the retrospective, registry-based study. The most common site of exposure was the leg (66.8%). In children under 8 years of age the face was more often involved than in adults (9.5% vs. 4.8%; p=0.03). The main type of exposure was a bite with bleeding (66.3%) followed by contamination of mucous membranes with saliva (19.7%). The primary sources were dogs (93.4%) followed by cats (2.6%). Children under 15 years were more likely to be exposed to dogs (94.9%) than adults (88.7%) (p=0.01). The most common way of coming in contact with animals was 'walking by' (83.9%). Children came in contact with animals while 'playing with' (10.7%) more often than adults (1.1%) (p<0.001). All the patients received an anti-rabies nervous-tissue vaccine, 99% of whom completed the vaccination course. Animal bites continue to be a problem in rural Ethiopia, mainly among children. Efforts to protect children against animal bites must be of paramount importance in preventing rabies in this population.

Key words

animal bites, animal-related injuries, rabies, anti-rabies vaccine, Ethiopia

INTRODUCTION

Animal attacks on people are still a huge medical and social problem worldwide resulting in millions of injuries and thousands of deaths [1]. Animal bites are the main source of rabies virus infection, a dreadful infectious disease that has not yet been brought under control in many parts of the world [2].

There are 50,000–55,000 people dying from rabies worldwide each year and over 3 billion people continue to be at risk of rabies virus infection in over 100 countries in the 21st century [3]. In Ethiopia, approximately 76 persons per million of the population receive anti-rabies post-exposure treatments annually due to the widespread nature of dog rabies in the country [4, 5].

Surveillance of animal-related injuries could provide useful information for planning and evaluating public health interventions [6]. It is important to know the epidemiology of animal bites and factors influencing post-exposure treatment for preventing human deaths due to rabies, and formulate rabies control strategies [7]. Although there have been several studies addressing the epidemiology of animal-related injuries, mainly dog bites [8, 9, 10, 11], very few have looked at the epidemiology of animal bites and potential rabies exposures in developing countries [7, 12, 13]. The presented report describes the characteristics of animal bites and utilization of anti-rabies vaccine over a two-year period in a rural area of southern Ethiopia

Address for correspondence: José Manuel Ramos, Infectious Diseases Unit, Hospital General Universitario de Elche, Camí L'Almazara 11, Elche 03203, Alicante, Spain
E-mail: jramosrincon@yahoo.es

Received: 26 February 2012; Accepted: 06 May 2014

MATERIALS AND METHOD

Type of study. A retrospective and registry-based descriptive study including animal-related injuries was performed. Consecutive patients with potential rabies exposures attending the outpatients clinic in Gambo Rural Hospital (GRH) from 11 September 2006 – 10 March 2010 (43 months) were included.

Study site and subjects. The GRH is a private mission hospital/rural general hospital with 135 beds, located in the West-Arsi zone, 250 km south of Addis Ababa. Due to an inadequate transportation network, the area covered by the GRH is restricted to approximately 95,000 inhabitants. Most of the population live in rural settings and work in agriculture and farming. The target population were those with potential rabies seeking rabies vaccination. Patients received a nervous tissue Ferme Type adult sheep brain anti- rabies vaccine produced by the Ethiopian Health and Nutrition Research Institute (EHNRI) Zoonoses Laboratory (Addis Ababa,

Ethiopia), free of cost. Bite victim individuals were given a full course of treatment with a dose of subcutaneous injections (3 or 5 c.c., depending on weight) in the area of the umbilicus for 14 consecutive days. A booster dose to be administered at day 14 after the last injection was prescribed. Neither rabies immunoglobulin instilled at the site of the bite nor intramuscularly was administrated to any patient in the GRH.

Collection and management. Health workers completed the 'Rabies post-exposure history and treatment card' previous to vaccination. Data recorded consisted of age, gender, site and type of exposure, type, extent and depth of injury, the animal ownership, type of contact with the animal, number of people bitten, date of vaccine treatment, and number of injections administered, including the booster dose.

Statistical analysis. Epidemiological and clinical data were entered in an Excel 97 programme. Data was analyzed using the SPSS, version 12, statistical package. Continuous variables are given as medians and interquartile range (IQR). Fisher's exact test, Student's t test and Kruskal-Wallis test were used for comparison where appropriate.

RESULTS

Of the 91,683 patients who attended the outpatients' department of the GRH in the period of study, 683 (0.74%) needed post-exposure anti-rabies treatment. Five cases of rabies were diagnosed during the study period at GRH. All of them came from areas outside the area covered by the GRH.

Of the 683 persons included in the study, 51.1% were females and 48.9% males. The median age of the study population was 9 years (IQR: 6 – 16; range: 2 month – 75 years). 73% were children: 38.2% under 8 years of age and 35.2% were aged between 8 and 15 years. The main characteristics of these individuals are shown in Table 1. The most common site of exposure was the leg (66.8%) followed by the arm. A bite with bleeding (66.3%) was the main type of exposure, followed by contamination of mucous membrane with saliva (19.7%) and minor scratches without bleeding (14%). More than one third of the cases had deep injuries. The primary sources of bites were dogs (93.4%) followed by cats (2.6%). 57% of the animals involved were pets with an owner. The most common contact with animals was 'walking by' (83.9%). Of the 492 victims interviewed, 67.8% reported that the animal involved had also bitten another person.

All patients received a Ferme type anti-rabies vaccine; the vaccination course was interrupted in only 0.7% of cases. No important complications were reported.

Table 2 shows the differences in the epidemiology between paediatric and adult patients. In children under 8 years of age the face as a site of exposition was more common than in other individuals (9.5% vs. 4.8%; p=0.03). Children under 15 years were most likely to be bitten by dogs (94.9%) than adults (88.7%) (p=0.01). Children came in contact with animals while 'playing with' (10.7%) more often than adults (1.1%) (p<0.001). However, unprovoked attacks were more common in adults than in children (6.1% vs. 1.1%; p=0.004).

Table 2. Differences in epidemiological data of animal injuries between paediatric patients (< 15 years) and adults (≥15 years)

	Paediatric patients	Adult patients	P value
Gender	(n=448)	(n=162)	
Male	237 (52.9)	86 (53.1)	NS
Female	211 (57.1)	76 (46.9)	NS
Site of exposure	(n=425)	(n=149)	
Leg	284 (66.8)	97(65.1)	NS
Arm	61 (14.4)	23 (15.4)	NS
Chest	49 (11.5)	22(12.4)	NS
Face	31 (7.3)	7 (4.7)	NS
Type of exposure	(n=439)	(n=118)	
Bite	291 (66.3)	100 (65.8)	NS
Saliva on mucous membrane	85 (19.4)	33 (21.3)	NS
Scratch	63 (14.4)	22 (14.2)	NS
Extent and depth of injury	(n=423)	(n=145)	
Superficial	177 (41.8)	64 (44.1)	NS
Deep	169 (40.0)	59 (40.7)	NS
Simple	63(14.9)	18 (12.4)	NS
Multiple	14 (2.5)	4 (0.7)	NS
Type of animal	(n=439)	(n=150)	
Dog	412 (94.9)	133 (88.7)	0.01
Cat	9 (2.1)	5 (3.3)	NS
Hyena	2 (0.5)	3 (2.0)	NS
Jackal	0(0.0)	1 (0.2)	NS
Others	11 (2.5)	8 (5.3)	NS
Animal owned	(n=319)	(n=110)	
Yes	175 (54.9)	67 (60.9)	NS
No	144 (44.9)	43 (39.1)	NS
Contact with the animal	(n=270)	(n=93)	
Walking by	227 (84.1)	76 (81.7)	NS
Playing with	29 (10.7)	1 (1.1)	<0.001
Feeding	12 (4.4)	8 (5.6)	NS
Unprovoked attack	2 (0.7)	6 (6.5)	0.004
Provoked attack	0 (0.0)	2 (2.2)	NS
Other persons bitten	(n=206)	(n=76)	
Yes	140 (68.0)	48 (63.2)	NS
No	66 (32.0)	28 (36.8)	NS
Interruption of anti-rabies vaccines	(n=444)	(n=161)	
Yes	2 (0.5)	3 (0.7)	NS
No	442 (99.5)	158 (98.1)	NS

DISCUSSION

The study shows that animal bites are still a major problem in this area of Ethiopia and confirms previous surveys indicating that they are also common in many parts of the country. According to the EHRNI rabies case record book, the proportion of human dog bites in Ethiopia increased in the period 2001 – 2009 [5]. The number of persons who received post-exposure prevention against rabies was in the range of 1,540 – 3,160 per year [5].

Table 1. Characteristics of patients, type of animal injuries and utilization of anti-rabies vaccine

Clinical features	Patients
Gender (n=614)	
Male	314 (51.1)
Female	300 (48.9)
Age (n=610) [median, years; IQR]	9 (6–16)
Age 0–7 years	233 (38.2)
Age 8–14 years	215 (35.2)
Age ≥ 15	162 (26.6)
Site of exposure (n=642)	
Leg	429 (66.8)
Arm	92 (14.3)
Chest	76 (11.8)
Face	45 (7.0)
Type of exposure (n=664)	
Bite	440 (66.3)
Saliva in mucus membrane	131 (19.7)
Scratch	93 (14.0)
Extent and depth of injury (n=636)	
Superficial	270 (42.5)
Deep	263 (41.4)
Simple	83 (13.1)
Multiple	20 (3.1)
Type of animal (n=656)	
Dog	613 (93.4)
Cat	17 (2.6)
Hyena	5 (0.8)
Jackal	1 (0.2)
Others	20 (3.0)
Animal owned (n=492)	
Yes	281 (57.1)
No	213 (42.9)
Contact with the animal (n=409)	
Walking by	343 (83.9)
Playing with	33 (8.1)
Feeding	23 (5.6)
Unprovoked attack	8 (2.0)
Provoked attack	2 (0.5)
Other persons bitten (n=317)	
Yes	215 (67.8)
No	102 (32.2)
Interruption of anti-rabies vaccines (n=678)	
Yes	5 (0.7)
No	673 (99.3)

Data are No. (%) of patients, unless otherwise indicated.
IQR – interquartile range

The profile of animal related injuries differ among countries depending on characteristics of animals involved [2, 5, 7, 12, 13]. In several studies, dogs were the primary animal species implicated, accounting for 63–80% of cases [2, 5, 9, 14]. In the current study, dog bites contributed to 93.2% of cases needing rabies post-exposure prophylaxis. This is in agreement with previous studies conducted in Ethiopia [2, 5] and India [7, 18]. Cats, with about 2% of animal bites, were the second most important source of injuries leading to post-exposure prophylaxis against rabies. Bites by wild animals, such as hyenas or jackals, were rare in this study, even though GRH is located in a rural area.

The most common anatomical location of bites was the leg, as reported in other studies [7, 9, 12, 13]. The second anatomical locations in frequency were the arms and hands, this in contrast to other surveys, in which injuries located in head, face or neck were more common [13]. Of note, in the presented study, children younger than 8 years of age were more likely to suffer injuries to the head than older children. This is also in agreement with other reports from the literature [12, 13, 15].

Of the 664 injuries assessed in the current study, two-thirds were animal bites and only one third were classified as minor injuries consisting in superficial lacerations and abrasions. This is in line with most previous studies in developing countries [7], although in some reports most cases had minor injuries [13]. Contamination of mucous membranes with saliva, classified as category III exposure according to the WHO [16, 17], accounted for 19.7% of cases, a figure higher than that reported in other studies (≈1–3%) [7, 18]. Minor scratches without bleeding, classified as category II according to the WHO [16, 17], occurred in 14% of the cases, a lower proportion than in others surveys (≈35%) [7, 18]. Of these, about half of the bites were inflicted by stray animals. In the studies performed in developing countries, most bites were inflicted by stray animals, which are unowned and unprotected [2, 5, 7].

Fatal cases of rabies in Ethiopia are more commonly seen in infants and school children [2, 5]. In the presented study, three out of four animal bite cases were in persons from 0–14 years of age. Children were also the population group most severely afflicted by animal bites in other reports [7, 9, 12, 13, 14, 19]. This is probably due to the fact that they play with pets at home and even in the streets in Ethiopia [2, 5]. Indeed, in the current study, it was more common for children to be bitten after 'playing with pets' than for adults to be bitten.

Although post-exposure phenolized sheep brain tissue vaccine used in the GRH is administered during a 14 days-course, it was remarkable that patients were highly adherent to therapy (≈99%). This may be explained by the 15-days free accommodation in a house near the GRH, provided for patients who lived more than an hour's walk away. In other reports, the adherence rate to anti-rabies postexposure prohylaxis was much lower [12]. The reasons for patient not completing anti-rabies vaccine regimens in previous surveys have included the lack of funds for a prolonged stay nearby a hospital with appropriate facilities, that would ultimately affect their school, work, and other personal activities [12].

It is interesting to note that despite the anti-rabies nerve-tissue vaccine being associated with a high risk of neurotoxicity [16, 17, 20], no neurological complications were observed among patients included in the current survey.

In other countries, the production of human anti-rabies nerve-tissue vaccines has been discontinued [7] following recent recommendations of the WHO Expert Committee on Rabies [17], and tissue-culture vaccines introduced instead. The recommended course for post-exposure vaccination with tissue-culture vaccines consists of only five injections (day 0, 3, 7, 14 and 28) [17]; therefore, it is easier to complete the full

vaccination course. The reasons why nerve-tissue vaccines are still in use in some countries, including Ethiopia, may include the perceived high cost of switching production technology and licensing of cell-culture vaccines [17].

Several limitations should be considered in relation to this study. Due to the fact that it was a retrospective survey, some of the data provided are incomplete, including the circumstances of the animal bite. The adverse sequelae, both cosmetically and physiologically, caused by the animal bite were not analyzed. Finally, the local treatment applied before arriving at the clinic, and the antibiotics administered were not recorded.

In conclusion, animal bites continue to be a problem in rural Ethiopia in the 21st century. As a result, there are many people at risk of rabies virus infection, especially children. The public health implications of animal attacks are significant, and awareness of the risks to young children needs to be emphasized. Although many people have already received educational material, it is important to increase efforts to improve education about rabies prevention, and to implement regulations for the impoundment and elimination of stray dogs. Dogs should also be routinely vaccinated to reduce the risk of transmission, and proper documentation of such vaccination should be ensured.

Acknowledgments

The authors express their thanks to the health care staff at the GRH for their assistance in attending the patients and the collection of data.

REFERENCES

1. Wunner WH, Briggs DJ. Rabies in the 21 century. PLoS Negl Trop Dis. 2010; 4: e591.
2. Yimer E, Neway B, Girma T, Mekonnen Y, Yoseph B, Badeg Z, et al. Situation of rabies in Ethiopia: a retrospective study 1990–2000. Ethiop J Health Dev. 2002; 16: 105–112.
3. Ogun AA, Okonko IO, Udeze AO, Shittu I, Garba KN, Fowotade A, et al. Feasibility and factors affecting global elimination and possible eradication of rabies in the World. J Gen Mol Virol. 2010; 2: 1–27.
4. Bogel K, MoTschwiller E. Incidence of rabies and post exposure treatment in developing countries. Bull World Health Organ. 1986; 64: 883–887.
5. Deressa A, Ali A, Beyene M, Newaye-Selassie B, Yimer E, Hussen K. The status of rabies in Ethiopia: A retrospective record review. Ethiop J Health Dev. 2010; 24: 127–132.
6. Emet M, Beyhun NE, Kosan Z, Aslan S, Uzkeser M, Cakir ZG. Animal-related injuries: epidemiological and meteorological features. Ann Agric Environ Med. 2009, 16, 87–92.
7. Ichhpujani RL, Mala C, Veena M, Singh J, Bhardwaj M, Bhattacharya D, et al. Epidemiology of animal bites and rabies cases in India. A multicentric study. J Commun Dis. 2008; 40: 27–36.
8. Balsamo GA, Ratard R, Claudet A. The epidemiology of animal bite, scratch, and other potential rabies exposures, Louisiana. J La State Med Soc. 2009; 161: 260–265.
9. Cornelissen JM, Hopster H. Dog bites in The Netherlands: a study of victims, injuries, circumstances and aggressors to support evaluation of breed specific legislation. Vet J. 2010; 186: 292–298.
10. MacBean CE, Taylor DM, Ashby K. Animal and human bite injuries in Victoria, 1998–2004. Med J Aust. 2007; 186: 38–40.
11. Wake AA, Minot EO, Stafford KJ, Perry PE. A survey of adult victims of dog bites in New Zealand. N Z Vet J. 2009; 57: 64–69.
12. Aghahowa SE, Ogbevoen RN. Incidence of dog bite and anti-rabies vaccine utilization in the, University of Benin Teaching Hospital, Benin City, Nigeria: A 12-year assessment. Vaccine. 2010; 28: 4847–4850.
13. Dwyer JP, Douglas TS, van As AB. Dog bite injuries in children – a review of data from a South African paediatric trauma unit. S Afr Med J. 2007; 97: 597–600.
14. Steele MT, Ma OJ, Nakase J, Moran GJ, Mower WR, Ong S, et al. Emergency ID NET Study Group: Epidemiology of animal exposures presenting to emergency departments. Acad Emerg Med. 2007; 14: 398–403.
15. Schalamon J, Ainoedhofer H, Singer G, Petnehazy T, Mayr J, Kiss K, et al. Analysis of dog bites in children who are younger than 17 years. Pediatrics. 2006; 117: e374–9.
16. Guidelines for post-exposure treatment in 8th Report of the WHO Expert Committee on Rabies. WHO Technical report. Series 824. Genewa, WHO, 1992.
17. WHO Expert Consultation on Rabies 2004. WHO Expert Consultation on Rabies: fist report. WHO Technical report series; 931. Geneva, WH0, 2005.
18. Ghosh TK. A study of animal bite cases in children. Assoc Prev Control Rabies India J. 1999; 1: 21–25.
19. Pancharoen C, Thisyakorn U, Lawtongkum W, Wilde H. Rabies exposures in Thai children. Wild Environ Med. 2001; 12: 239–243.
20. Swaddiwuthipong W, Weniger BG, Wattanasri S, Warrell MJ. A high rate of neurological complications following sample anti-rabies vaccine. Trans R Soc Trop Med Hyg. 1988; 82: 472–475.