A Retrospective Analysis of Animal Bite Victims Suspected for Rabies Exposure Cases Admitted to Wolaita Sodo University Teaching Referral Hospital from 2013 to 2018 Years

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Abstract: Rabies is a viral disease that affects all warm-blooded animals including humans. The disease is transmitted from affected animals to susceptible animals and humans through animal bites. A retrospective study was conducted in Wolaita Sodo University Teaching Referral Hospital to assess the status of human rabies suspected cases and identify risk factors for the animal bite from clinical case records. A total of 1023 animal bite victims suspected of exposure to rabies were admitted to the hospital for the purpose of post-exposure prophylaxis and treatment from September 2012 to August 2018. Among the admitted cases, seventy-six victims (7.4%) were reported as fatal. All suspected victims were not received post-exposure prophylaxis and treatment ($p<0.05$). Results of suspected rabies spatial distribution identified that most of the cases were referral from other districts such as Boloso Bombe and Boloso Sore districts. 79.6% of the victims were exposed to bites and scratches by dogs. Among the victims, children younger than 15 years were highly affected (39.1%), whereas those older than 36 years were the least affected. Males were relatively more vulnerable victims (58.4%) compared to female. Relatively, limbs were bitten at higher proportion (20.1%) compared to other parts of the body. The highest number of animal bite victims 190 (18.6%) were recorded from September 2015 to August 2016. Most animal bite cases 130 (12.7%) were recorded during the month of September, whereas the lowest 56 (5.5%) were recorded during the month of February. In conclusion, rabies was found to be well established disease in the study area, and is at the level that can be considered as a problem that posse higher magnitude of public health risk. It is recommended that prevention and controlling strategies should be implement against rabies disease by human and animal health sectors in the Zone.

Keywords: *Animal bite, Case records, Human rabies, Interventions, Risk factors*

Introduction

Rabies is a severe and fatal viral disease affecting central nervous system of warm–blooded animals, including man (Van Regenmortel, 2000). The virus belongs to the order *Mononegavirales,* family *Rhabdoviridae*, and genus *lyssavirus.* It is one of the most virulent diseases of humans and animals with worldwide distribution (Krauss *et al.,* 2003).

Globally, rabies is estimated to cause more than 1.9 million disability-adjusted life years (DALYs) in 2012 (WHO, 2013). The risk of the disease is highest in Asia and Africa accounting for approximately 59,000 human deaths with over 172,000 disability-adjusted life years (DALYs) and 8.6 billion USD economic losses annually (WHO, 2013).

Ethiopia is among high burden African countries in regard to human rabies virus exposure since ancient times (WHO, 2013). Exposure to rabies has been reported from all regions of the country. However, high incidence rate has been reported from Addis Ababa city and northern parts of the country (EPHI, 2012). The burden of rabies was estimated to be approximately 97,000 exposed persons; 3,000 human deaths; 2 million USD treatment costs and 194,000 DALYs annually (Tariku *et al*., 2018).

Dogs serve as a reservoir and cause around 99% of all human deaths from rabies (WHO, 2013), while bats, cats, and wildlife contribute to the remainder (Franka *et al*.,2013). In Ethiopia; dogs, cats, some domestic animals and wildlife species are known to transmit rabies virus to both humans and livestock. Few studies available on human exposure to rabies and confirmed diagnosis of rabid biting animals showed that dogs contributed to the highest number of the total fatal human rabies cases (Eshetu *et al*.,2012; Gebreyohans *et al*., 2017; Tariku *et al*., 2018; Gebreyohans *et al*., 2019).

Worldwide, over 7.5 million rabies post-exposure prophylaxis (PEP) regimens are delivered annually at an estimated cost of more than US$1.5 billion (WHO, 2013). In most of the world, the access of PEP is limited in many rural areas within the 24-hour period recommended for treatment initiation after exposure to rabies (Quiambao *et al*., 2005).

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 (Eshetu *et al.,* 2012). Despite the availability of vaccines both to human and dogs in the country only 3.9% dogs were vaccinated between 2009-2012 in Addis Ababa (Reta *et al*., 2014). According to the annual report of Ethiopian Health

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and Nutrition Research Institute (EHNRI) between 2001-2009 years; the average anti-rabies vaccine production for animal and human use was about 9450 and 14,519 doses respectively per year, which was below the demand for domestic consumption (Asefa *et al*., 2010).

Only few studies, mainly limited to the central part and few regions of the country, are available on zoonotic rabies status and management capacity for exposed community in Ethiopia (Asefa *et al*., 2010; Reta *et al*., 2014; EPHI, 2012; EPHI, 2017). Therefore, this study was undertaken to find out the status of the animal bite victims suspected for rabies exposure from 2013 to 2018 in Wolaita Sodo area, Ethiopia.

Materials and Methods

Study Area

This study was conducted in Wolaita Sodo University Teaching Referral Hospital (WSUTRH) which found in Sodo town. It is the only referral hospital in the area. Sodo town is the administrative town of Wolaita Zone, South Nation's, Nationalities and Peoples Region (SNNPR), Ethiopia. Sodo town is located about 390 km away from Addis Ababa. The town is located at latitude of 6°54°N and longitude of 37°45°E with an elevation between 1600 and 2100 meters above sea level. The maximum annual temperature is 26.2°C and minimum annual temperature is 11.4°C.

Study Units and Design

Residents of Wolaita and other nearby Zones which were victims of animal bite and admitted to WSUTRH for the purpose of seeking PEP and treatment from September 2012 to August 2018 were included in the retrospective study.

Data Collection and Analysis

Clinical and demographic information records on all animal bite victim people who admitted from September 2012 to August 2018 at WSUTRH was collected using designed check list for this purpose. The main information reviewed for each animal bite victim individual were: date of examination (Day/Month/Year); age, gender and address of the patient; body part affected; animal responsible for injury; base of diagnosis, the measures taken and death report. Finally, the data were entered into Microsoft excel spread sheet and analyzed using SAS software, version (9.1.3). The chi-square test was used to observe presence of exposure difference between the co-variants. P-value ($p<0.05$) was considered as significant.

Results

Spatial Distribution of Animal Bite Victims Suspected of Rabies Exposure

A total of 1023 animal bite victim people were admitted to WSUTRH, for post-exposure prophylaxis treatment after exposure to either a known rabid or rabies suspected animals from September 2012 to August 2018. Based on spatial distribution, highest number of suspected cases (n=122/1023) were admitted to the hospital from other neighboring Zones. The Zone(s) and districts of these victims were not clearly identified in the clinical records. Therefore, only data obtained from districts of Wolaita Zone were used for risk factor. The suspected cases came from other neighboring Zones were recorded only as they were from other Zone without specific name of Zone and patient districts, therefore we didn't compare it with the suspected cases from Wolaita Zone districts. Maximum number of cases 89 (8.7%) was admitted from Boloso bombe district, due to that it was the highly affected district in Wolaita Zone and 64 (6.3%) in Dugna Fango was the minimum among districts of Wolaita Zone as seen in Table 1.

Table 1. Spatial distribution of animal bite victims suspected for rabies exposure

Districts	**Animal bite victims suspected for rabies exposure**	
	Number	**Percentage**
Boloso Bombe	89	8.7
Boloso Sore	86	8.4
Dugna Fango	64	6.3
Damot Gale	74	7.2
Damot Pulasa	78	7.6
Damot Sore	78	7.6
Damot Wolda	69	6.7
Humbo	79	7.7
Kindo Didaye	78	7.6
Kindo Koisha	66	6.4
Offa	74	7.2
Sodo Zuria	66	6.4
All other districts from non Wolaita Zones	122	11.9
Total	**1023**	**100**

Demographic Characteristics of Animal Bite Victims Suspected for Rabies Exposure

Among 1023 animal bite victim people who suspected for rabies exposure admitted, for post-exposure prophylaxis treatment, children younger than 15 years were highly affected (400, 39.1%) followed by 15-25 years (381, 37.2%), while those older than 36 years were relatively the least affected as presented in Table 2. The gender-specific distribution showed that the majority of victims were males 597 (58.4%) in contrast to females 426 (41.6%).

Table 2. Age groups and gender wise distribution of animal bite victims suspected for rabies exposure

Variable	Categories	Animal bite victims suspected for rabies exposure	Percentage
Gender			
	Female	426	41.6
	Male	597	58.4
	Total	**1023**	**100.0**
Age (years)			
	<15	400	39.1
	15-25	381	37.2
	25-36	142	13.9
	>36	100	9.8
	Total	**1023**	**100.0**

Temporal Distribution of Animal Bites Victims Suspected for Rabies Exposure

Among the study years, the highest number of animal bite victims suspected of exposure to rabies, 190 (18.6) was recorded in September/2015 to August/2016 years followed by 175 (17.1%) in September/2012 to August/2013 and 172 (16.8%), 166 (16.2%) and 170 (16.6%) in years September/2013 to August/2014, September/2014 to August/2015 and September/2016 to August/2017, respectively. While from September/2017 to August/2018 was the years in which relatively the lowest 150 (14.7%) suspected cases were reported. Monthly exposure to rabies conditions significantly varied from highest in September 130 (12.7%), moderate 86 (8.1%) in June to lowest 56 (5.5%) in February as seen in Table 3.

Table 3. Yearly and monthly distribution of animal bite victims suspected for rabies exposure

Months	ABVSRE	Percent	Years	ABVSRE	Percent
January	58	5.6	Sep/2012 -Aug/2013	175	18.6
February	56	5.5	Sep/2013 -Aug/2014	172	16.8
March	65	6.3	Sep/2014 -Aug/2015	166	16.2
April	63	6.1	Sep/2015 -Aug/2016	190	18.6
May	70	6.8	Sep/2016 -Aug/2017	170	16.2
June	86	8.4	Sep/2017 -Aug/2018	150	14.7
July	94	9.1	**Total**	**1023**	**100**
August	117	11.4			
September	130	12.7			
October	113	11.0			
November	85	8.3			
December	86	8.4			
Total	**1023**	**100**			

ABVSRE= Animal bite victims suspected for rabies exposure; Sep= September; Aug= August.

Animal Responsible for Injury and Body Parts Affected

Most of the victims 206 (20.1%) were exposed to injuries on their limb, 163 (15.9%) on the hand and 29 (2.8%) on their head. Dogs were responsible for either bite or scratch of 814 (79.6%) of rabies suspected cases admitted to the Hospital, whereas cats 83 (8.1%) were the second most responsible species of animal. Horses, donkeys, cattle, hyenas and other unspecified animals were responsible for the rest of the injuries 126 (12.3%; Table 4).

Diagnosis and Measures Taken

Most of the cases admitted to the hospital (943, 92.2%) were diagnosed based on history and the rest 80 (7.8%) cases were diagnosed based on some observed clinical signs like fever, difficulty swallowing, confusion, and paralysis. For majority of the victims 651 (63.3%), PEP was given in addition to wound management, while 372 (36.4%) were solely treated by wound management as shown in Table 5.

Table 4. Animal responsible for injury and body parts affected

Variables		Animal bite victims suspected for rabies exposure	Percentage (%)
Animal responsible for injury			
	Cat	83	8.1
	Dog	814	79.6
	Others	126	12.3
	Total	**1023**	**100.0**
Injury type	**Body part affected**		
Bite	Belly	36	3.5
	Hand	163	15.9
	Head	29	2.8
	Lower limb	206	20.1
	Other parts	153	15.0
Scratch	Belly	65	6.4
	Hand	107	10.5
	Head	53	5.2
	Lower limb	132	12.9
	Other parts	79	7.7
	Total	**1023**	**100.0**

Table 5. Diagnosis and measures taken

Variables	Animal bite victims suspected for rabies exposure	Percentage
Base of diagnosis		
Clinical sign	80	7.8
History	943	92.2
Total	**1023**	**100.0**
Measurement taken		
PEP and wound management	651	63.6
Wound management only	372	36.4
Total	**1023**	**100.0**

Death Report

From a total of 1023 people admitted to the hospital for PEP, 76 (7.4%) people were reported as fatal. Among the age group; 15-25 years old were take the most fatal number of people 34 (44.7%), followed by the children younger than 15 years 26 (34.2) however the difference is not statically significant $p > 0.05$ as presented in Table 6. All of the fatal cases have not received the PEP treatment ($p < 0.05$). According to this report, 60.5% (n=46/76) of the deceased were male and 39.5% (n=30/76)) were female; the difference is no statistically significant $p > 0.05$.

Table 6. Death report

Variable	Death report		Total	P Value
	Yes (%)	No (%)		
Age group				0.15
<15	26 (34.2)	374 (39.5)	400	
15-25	34 (44.7)	347 (36.6)	381	
25-36	13 (17.1)	129 (13.6)	142	
>36	3 (3.9)	97(10.2)	100	
Total	**76**	**947**	**1023**	
Gender				
Male	46 (7.7)	551(92.3)	597	0.39
Female	30 (7.04)	396 (93)	426	
Total	**76**	**947**	**1023**	
Management/treatment taken				
PEP and wound management	0 (0)	651(100)	651	0.01
Only wound management	76 (20.4)	296 (79.5)	372	
Total	**76**	**947**	**1023**	

Discussion

In this retrospective study suspected rabies cases admitted for PEP at Wolaita Sodo University Teaching Referral Hospital from September 2012 to August 2018 was 1023. This number is lower than the number of cases reported from a study done in Jimma and its surroundings (Tadele *et al*., 2014).

The findings of this study indicated that majority of animal bite victims (58.4%) were males. This might be due to activities of males, in that they engaged, they are more laborious and travel many distances every day. Most of the time males are also aggressive towards biting animals due to they would be exposed to animal centered attacks (Aworh *et al*., 2011). Relatively females spent most of their time through indoor activities and they are friendlier to the animals (Ramos *et al*., 2015). The same findings were reported in other parts of Ethiopia by different studies (Asefa *et al*., 2010; Meseret and Dabasu, 2015).

Children under the age of 15 years constituted the highest proportion (39.1%) of the victims followed by those aged 15-25 years. This result is in agreement with previous reports in different parts of Ethiopia Meseret and Dabasu (2015) in Gondar, Tadele *et al.* (2014) in Jimma and Mazigo *et al.* (2010) in Tanzania. Children could be more vulnerable because of their lack of awareness and experience about dog behaviour, closeness to the dogs' mouth, and provoking animals to attack (Ozanne–Smith *et al*., 2001). Children are more likely to engaged in daily grazing of sheep, cattle and other animals where they might be exposed to wondering rabid dogs; play with pets at home and on streets (Asefa *et al.,* 2010; Eshetu *et al*., 2012). In addition, inability to protect themselves against attacks from dogs may be partly responsible for the higher number of exposures in children.

Although animal rabies and animal bites thereof could occur during any month of the year, it is indicated in the current study that animals caused considerable percentage of the injuries during the months of July, August, September and October. This result is in agreement with the findings of Reta *et al.* (2014), Eshetu *et al.* (2012), Mazigo *et al.* (2010) and Zhang *et al.* (2012) that reported rabies outbreak occurring annually between July and September, this could be due to cold season where animals, especially, dogs travel long ways in search of food and mating in which case many rabies risk full contacts could happen. However, the result of current study is contrary to the findings of Tadele *et al.* (2014), who reported exposure to rabies suspected animals occurred during the months of December, January, and February. This difference might be due to the climatic variations associated with geographical locations of each respective study areas. There was significant variation in the monthly distribution of rabies suspected cases.

The results of this study showed that human rabies exposure cases recorded across the study years was the highest during September, 2015 to August, 2016 (190) and the least (150) during September, 2017 to August, 2018. This finding is in agreement with a study done in Addis Ababa and its surroundings by Ministry of Health between 2015 and 2016, on which the human rabies cases were by far higher in 2016 (EPHI, 2017).

In this study, dogs were the most responsible animals for bite and scratch 814 (79.6%). This finding is in agreement with findings of Ramos *et al.* (2015) and Gebreyohans *et al.* (2019). This could be due to high population of dogs in the area, lack of dog vaccinations and high prevalence in the area of stray dogs.

The most common anatomical location of exposure was the lower limbs succeeded by hands, this finding is in agreement with studies of (Fasil *et al*., 2011; Joshua *et al*., 2017). The result of this study is in contrast to Dwyer *et al.* (2007), in which most of the injuries for children less than six years were located on the head, neck, and face. This might be explained by the fact that their short stature exposed them to head, neck and face injuries (Joshua *et al*., 2017).

Of the 1023 animal injuries assessed in this study 943 were diagnosed based on history from the victims own description of the type and nature of injury, the status of bite or scratch and involved animals. Others were diagnosed through clinical signs, such as open wounds, scratches, bleedings and deep bites. Several cases were also admitted to the hospital after developing clinical signs for rabies. Eighty of the victims had already developed clinical signs like; fever, difficulty swallowing, paralysis, and confusion during admission and wound management was the only treatment given.

As the result of Presence data from neighboring Zones is the cumulative sum of many none specified districts, it was not possible to categorize districts as high or low with regards to animal victims suspected to rabies exposure cases in those areas. However, in districts from Wolaita Zone, where such distinction was available, exposures appear to be similar across the districts. The highest (8.7%) proportion was from Boloso bombe and the lowest (6.3%) was recorded from Dugna fango.

Among the reported case related deaths, the age group range of 15-25 years reported most of the fatal outcomes 34 (44.7%), followed by children younger than 15 years 26 (34.2). The result of this study is in contrast to the study done in Addis Ababa by Asefa *et al.* (2010), in which most fatal cases were from the age group of 0-14 years. According to this report, all of the fatal cases were from those of who have not received the PEP treatment. This implies that promptly administered PEP might have reduced fatal outcomes in the receiving groups.

Conclusion

Our study demonstrated that rabies is well established disease in the area which was responsible for human life lose. A significant number of peoples were exposed to rabies due to dogs and other animal bites. Children younger than 15 years old exposed to the highest proportion of animal bite victims. More proportion of victims were male and in cold season (July, August,

September, and October) in the area. The result of the present study indicated that rabies prevention and controlling strategies should be implemented in the area by human and animal health sectors in the region.

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Conflict of Interests

The authors declare that they have no competing interests.

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