Review Article

RABIES: ZOONOTIC DISEASE AND PUBLIC HEALTH

Samiksha Adhikari
Agriculture and Forestry University,
Email- adksami@gmail.com

Abstract
Rabies is a preventable viral disease of mammals that can be transmitted through the contamination of a rabid animal. Human rabies remains a matter of great global concern with a case-fatality of almost 100%. Rabies is not curable if it occurs in living being but in humans it is 100% preventable through prompt appropriate medical care. To mitigate the rabies, short term and long-term strategy must be made world widely collaborating with different organization such as WHO, OIE, etc.
Keywords- rabies, zoonotic, human

Introduction

Rabies is a viral disease of mammals that can be preventable and transmitted through the contamination of a rabid animal (*Rabies | CDC*, n.d.). It is caused by ***Rabies lyssavirus***, formerly known as *Rabies virus* that usually effects on central nervous system. It is usually seen in domestic dogs and wild carnivorous animals by a bite of rabid animal (*rabies | Definition, Causes, Symptoms, Treatment, & Facts | Britannica*, n.d.)(*Rabies virus - Wikipedia*, n.d.). In this 21st century, dogs are known as the most important reservoir of rabies. Many human cases have also been recorded due to exposure to rabid cats and wildlife. Some wildlife reservoirs of rabies are Mongoose (*Herpestes* spp.), jackals (*Canis aureus*), foxes (*Vulpes bengalensis*) and wolves (*Canis lupus*) in Bangladesh, India, and Nepal (*What is rabies?: OIE - World Organisation for Animal Health*, n.d.). It is most neglected zoonotic disease but have more importance in the field of public health. It is prevalent in more than 150 countries and territories of all continents except Antarctica. About 60,000 people die of rabies every year, mostly in Asia and Africa(*WHO | Rabies: A neglected zoonotic disease*, n.d.).

History

Rabies is one of the most important zoonotic diseases that have been well known since for 4300 years (Takayama, 2008). However, in Asia, robust scientific investigation of the disease begins after 1885, with Louis Pasteur's discovery of post exposure vaccine against rabies.

Transmission and Epidemiology

Transmission can occur when infected material comes into direct contact with human mucosa or fresh skin wounds. Transmission of rabies through inhalation of virus through aerosols route or through transplantation of infected organs is rare as well transform of rabies through consumption of raw meat or animal-derived tissue has never been confirmed in humans. The virus can enter into the body through wounds or direct contact of saliva, cerebrospinal liquid, nerve tissue to mucous membranes or skin lesions. The virus cannot penetrate intact skin (Knobel et al., 2013). After entry the virus binds to cell receptors. Viruses may replicate within striated muscle cells or directly infect nerve cells. The virus replicates rapidly once it reaches to the CNS which cause different pathologic effect on physiology of nerve cell.

The 99% of the rabies cases are usually transmitted due to bite or scratch from rabid animal to humans. About 95% of rabies death are belongs to Africa and Asia that accounts the highest burden in human worldwide (*Rabies - VaccinesToday*, n.d.), (Willoughby et al., 2005), (*Transmission and pathogenesis | Rabies - Bulletin - Europe*, n.d.). Dog-mediated rabies has been eliminated from Western Europe, Canada, the United States of America, Japan and some Latin American countries. Some countries like Australia and many Pacific island nations have always been free from dog-mediated rabies (Devleesschauwer et al., 2016).

Public Health Importance

Approximately 189 people die from rabies per day, primarily in developing countries (*Rabies: Zoonotic Diseases and Public Health – Public Health @ Cornell*, n.d.). Human rabies remains a matter of great global concern with a case-fatality of almost 100%

(Takayama, 2008), (Willoughby et al., 2005), (*Rabies*, n.d.). The 99% of rabies cases are dog-mediated and the burden of disease is disproportionally borne by rural poor populations, with approximately half of cases attributable to children under 15 (Devleesschauwer et al., 2016). In Asia, with an estimated 35,172 human deaths per year, it is major burden zoonotic disease (Devleesschauwer et al., 2016). An estimated 21,476 human deaths occur each year in Africa due to dog-mediated rabies (*WHO | Rabies: A neglected zoonotic disease*, n.d.). With these data we can expect that how serious is the matter 'Rabies' and we have to give some attention to eliminate it worldwide.

Treatment, Prevention and Controls

Rabies is not curable if it occurs in living being but in humans it is 100% preventable through prompt appropriate medical care (*Rabies Prevention | Prevention | CDC*, n.d.). Rabies can be prevented by immunization. Some measure that we can adopt to prevent rabies are:

- With some quantitative indicators, evaluation and monitoring can be done as:
  - Reduction in animals dying of rabies as confirmed by the laboratory;
  - Number of dogs vaccinated (and revaccinated after recommended intervals); · Number of dogs in a defined population; Mass vaccination in prone area can be done.
  - Availability of PET in district and peripheral hospitals;
  - Number of drop outs in pet dogs;
  - Quantity of vaccine utilized for human and animal use;
  - Quantity of anti-rabies serum consumed, and
  - Number of training courses organized and persons trained.

Some ideas that Government can do to mitigate the rabies:

- Formulation of a national policy and plan for elimination/control of rabies within a stipulated period with allocation of suitable resources to sustain the program on a long-term basis is essential.
- Establishment of a national committee on control of rabies to provide technical guidance to the Government on development, implementation and monitoring of a comprehensive nationally coordinated Rabies Control Program should be considered a top priority. This committee shall have senior representatives and national experts from all those agencies that are intended to play a part in control activities. It must be headed by the top technical or administrative official of the country and meet very frequently.
- Formulation of a National Rabies Control Program with appropriate legislative, infrastructural and logistic support on a sustained basis and providing detailed guidelines for implementation of the objectives.
- Ensuring a strong partnership between various national and international players from administrative units, private sector, NGOs and general communities is crucial for generating new resources, pooling existing resources and working in collaboration to generate synergistic results.
- Development of realistic targets and indicators is necessary to assess the progress made in achieving the targets.
- Strengthening local capabilities and integrating rabies control activities in existing health and veterinary systems of federal, provincial as well as local civic bodies and coordinating with other developmental works would increase intersectoral cooperation.
- Enhancing national capacity in production, distribution and storage of biological (vaccines and anti-rabies serum) and/or ensuring purchase of these from international market in bulk at most competitive price would ensure their availability for anti-rabies treatment.
- In the prone areas, Culling, or the widespread killing of must be conducted by assuming if host densities are reduced, infectious diseases will be unable to persist (Rosatte, 2013).

The United Against Rabies collaboration: a worldwide chemical change platform to attain zero human Rabies deaths by 2030.

WHO, Food and Agriculture Organization (FAO), international organization for Animal Health (OIE) and therefore the Global Alliance for Rabies Control (GARC) came along in 2015 to adopt a typical strategy to achieve "Zero human Rabies deaths by 2030" and shaped the United Against Rabies collaboration.

This initiative marks the first time that both the human and animal health sectors have come

together to advocate for, and prioritize investments in rabies control and coordinate the global rabies-elimination efforts. Zero by 30: the worldwide strategic conceive to finish human deaths from dog-medicated Rabies by 2030 developed by the United Against Rabies collaboration can guide and support countries as they develop and implement their national Rabies elimination plans that embrace the ideas of One-health and cross-sectoral collaboration.

In Context of Nepal

About 100 livestock and 10–100 humans are killed by rabies, per year while about 1,000 livestock and 35,000 humans receive rabies post-exposure prophylaxis. [7] Rabies in Nepal occurs in two interrelated epidemiological cycles: an urban cycle involving domesticated dogs and a sylvatic cycle involving wildlife. [12] The urban cycle is the predominant source of human rabies, with more than 96% of rabies patients reported during 1991–2000 showing a history of rabid dog exposure (Devleesschauwer et al., 2016). The urban cycle is maintained by the stray and community dog population, with spill-overs to pet dogs adding to the human rabies burden. The sylvatic cycle is maintained by wild carnivores living in forest zones, national parks, or wildlife reserves, such as mongooses (family *Herpestidae*) and jackals (*Canis aureus*). [12] Although this cycle possesses a significant indirect importance in the source of infection for urban area, it is thought to be less important in Nepal. [12] Nevertheless, a correct understanding of the sylvatic cycle is lacking.

Significant progress has been created within the production of cell culture-based anti-rabies immunogen and rabies immunoglobulin, but accessibility and supply remain a matter of concern, particularly in remote areas. Different state and non-state actors have initiated rabies control activities over the years, however efforts generally remained focalized, of short period and not harmonic. Communication and coordination between veterinary and human health authorities is proscribed nowadays, additional complicating rabies management in Nepal.

Conclusion

Hence, Rabies is the most important zoonotic disease in spite of being neglected in developing countries in terms of public health. So, the entire nation should make short term and long-term strategy to eliminate out collaborating with different organization such as WHO, OIE, etc.

Acknowledgement

I express my deepest thanks to Authors of different articles and books for making my study easier. I choose this moment to acknowledge his/her contribution gratefully.

References

Devleesschauwer, B., Aryal, A., Sharma, B. K., Ale, A., Declercq, A., Depraz, S., Gaire, T. N., Gongal, G., Karki, S., Pandey, B. D., Pun, S. B., Duchateau, L., Dorny, P., & Speybroeck, N. (2016). Epidemiology, Impact and Control of Rabies in Nepal: A Systematic Review. *PLOS Neglected Tropical Diseases*, *10*(2), e0004461. https://doi.org/10.1371/journal.pntd.0004461

Knobel, D. L., Lembo, T., Morters, M., Townsend, S. E., Cleaveland, S., & Hampson, K. (2013). Dog Rabies and Its Control. In *Rabies* (pp. 591–615). Elsevier Inc. https://doi.org/10.1016/B978-0-12-396547-9.00017-1

Rabies: Zoonotic Diseases and Public Health – Public Health @ Cornell. (n.d.). Retrieved October 10, 2020, from https://blogs.cornell.edu/onehealth/2017/04/06/rabies-zoonotic-diseases-and-public-health/

Rabies. (n.d.). Retrieved October 10, 2020, from https://www.who.int/news-room/fact-sheets/detail/rabies

Rabies - VaccinesToday. (n.d.). Retrieved October 10, 2020, from https://www.vaccinestoday.eu/diseases-vaccines/diseases/rabies/

Rabies | CDC. (n.d.). Retrieved October 10, 2020, from https://www.cdc.gov/rabies/index.html

rabies | Definition, Causes, Symptoms, Treatment, & Facts | Britannica. (n.d.). Retrieved October 10, 2020, from https://www.britannica.com/science/rabies

Rabies Prevention | Prevention | CDC. (n.d.). Retrieved October 10, 2020, from https://www.cdc.gov/rabies/prevention/index.html

Rabies virus - Wikipedia. (n.d.). Retrieved October 10, 2020, from https://en.wikipedia.org/wiki/Rabies_virus

Rosatte, R. C. (2013). Rabies Control in Wild Carnivores. In *Rabies* (pp. 617–670). Elsevier Inc. https://doi.org/10.1016/B978-0-12-396547-

9.00018-3

Takayama, N. (2008). Rabies: A preventable but incurable disease. In *Journal of Infection and Chemotherapy* (Vol. 14, Issue 1, pp. 8–14). Springer Japan. https://doi.org/10.1007/s10156-007-0573-0

Transmission and pathogenesis | Rabies - Bulletin - Europe. (n.d.). Retrieved October 10, 2020, from https://www.who-rabies-bulletin.org/site-page/transmission-and-pathogenesis

What is rabies?: OIE - World Organisation for Animal Health. (n.d.). Retrieved October 10, 2020, from https://www.oie.int/en/animal-health-in-the-world/rabies-portal/what-is-rabies/

WHO | Rabies: A neglected zoonotic disease. (n.d.). Retrieved October 10, 2020, from https://www.who.int/rabies/home_more/en/

Willoughby, R. E., Tieves, K. S., Hoffman, G. M., Ghanayem, N. S., Amlie-Lefond, C. M., Schwabe, M. J., Chusid, M. J., & Rupprecht, C. E. (2005). Survival after treatment of rabies with induction of coma. *New England Journal of Medicine*, *352*(24), 2508–2514. https://doi.org/10.1056/NEJMoa050382