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Epidemiology of Rabies and the Control Challenges

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Abstract

Globally lyssaviruses are biologically interested because of the human and animal health issues**.** Lyssaviruses are responsible to cause fatal encephalitis which is mentioned with the name of rabies infection. Rabies is the most prevalent fatal and acute zoonotic disease worldwide. The annual mortality ratio of rabies in humans is almost 59000 among 150 countries, out of which 95% in the Asia and Africa. Rabies virus transmission is mostly occur when the infected animal bite or engrave to the other susceptible animal or humans. Diagnosis is mainly dependent on the clinical signs & symptoms, history of the infected individual, mortality and vaccination prophylaxis. The objective of this communication was to review the epidemiology of rabies, transmission, diagnosis and current control challenges globally**.**

Introduction

Rabies is the most prevalent fatal and acute zoonotic disease worldwide. Almost all the mammals and humans become infected with the rabies. The genome of rabies virus consist of RNA with five genes includes glycoprotein (G), nucleoprotein (N), a viral RNA polymerase (L) matrix protein (M) and Phosphoprotein (P). The main important role of virus gene nucleoprotein (N) involved in the pedigree analysis of virus, sequencing analysis, replication and transmission of the virus. It mainly affects the brain and spinal cord causes inflammation and severe damage to these parts. In Clinical point of view rabies exist in two types one of them is furious rabies which can be observed with hyperactivity and hallucination while, second one is paralytic rabies which can be observed by paralysis of different body parts. The transmission of this zoonotic disease to humans is possible through infected animals like bats, foxes, jackals and the most important reservoirs are dog. More than 99% human get infected with dogs and therefore rabies is a highly familiar zoonotic disease in the world. It is familiar in human population due to close contact of human to dog activities. The possible reason of this prevalence in humans is also due to scarcity of preventive measure knowledge which can observe the rabies level in humans and other domestic animals. The aim of this communication was to review the epidemiology of rabies, transmission, diagnosis and current control challenges globally.

Epidemiology in Developing Countries

Epidemiology of rabies is endemic to all over the world except some European regions and islands, but the mortality ratio is 99% in the underprivileged countries. It is observed most prevalence of rabies in those countries

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which have insufficient supply of diagnostic potential and less inspection system for rabies. However, the basic reason of the rabies prevalence today is also due to when someone affects with rabies and died but their exact record not exactly known. Rabies vaccination through unhygienic syringes is also a risk of other blood born pathogenic diseases like HCV, HBV, and HIV in the developing countries. Some of the human rabies affected countries are at risk of canine rabies burden. The annual mortality ratio of rabies in humans is almost 59000 among 150 countries, out of which 95% in the Asia and Africa. But the rural areas are more affected with 84% mortality ratio. In many countries rabies mostly affect the children even it is curable zoonotic disease but it is not productively eliminate through many of the developing countries.

Transmission

Rabies virus transmission is mostly occur when the infected animal bite or engrave to the other susceptible animal or humans. Rabies transmission is also possible if the humans get direct exposure with the saliva of infected animals to their mucosa or skin lesions. Rabies transmission is mostly depends on season with high prevalence in the late summer or autumn because mostly wild animals searching their partner for mating and nutrition. In the developing countries it is expected urban disease because due to large contact of humans with domestic animals.

Signs and Symptoms

The clinical symptoms of the rabies are mostly unconditional. Mostly incubation period of rabies is 2 to 3 months but may exceed up to one year because due to different factors as viral entry point and viral concentration. The main early symptoms are pyrexia with torture, tingling and paraesthesia at the lesion area. It causes serious swelling of the brain and spinal cord when it gets enter to the central nervous system. The animals affected with rabies virus express particular signs of CNS neurosis with little differences within species. It depends on the three kinds of stages like prodromal, excitative and end-stage which can be varied on the differences of clinical signs and duration of the stages.

Diagnosis

Before starting of clinical disease the present diagnostic approaches are not satisfactory for the identification of rabies infection and moreover rabies particular symptoms of hydrophobia are exist. Diagnosis is mainly dependent on the clinical sign & symptoms, history of the infected individual, mortality and vaccination prophylaxis. Fluorescent antibody test (FAT) is an excellent premortem procedure to diagnose the viral antigen and the postmortem procedure is the inspection of negri bodies in the brain. World Health Organization (WHO) approved the FAT which ensures 95 to 99 % accurate results after the few hours. Immunohistochemistry test is also specific with their results like FAT used for the detection of antigens.

- Diagnostic approaches for antigen identification.
- Isolation procedures for cell culture.
- Enzyme linked Immunosorbent assay (ELISA).
- Virus diagnosis using monoclonal antibodies.
- Rabies antibodies identification tests.

Treatment

Rabies is a fatal disease and before the onset of clinical symptoms there is no particular treatment however it can be preventable. It's very important to provide effective treatment to the suspected patients before the appearance of symptoms and death. After the rabies manifestation post-exposure prophylaxis (PEP) is the instant therapy for the bite to the infected individual which controls the entry of virus into the CNS to prevent the death. Different steps of PEP treatment as,

- After the suspected manifestation immediately washing the infected area and disinfectant.
- Immediately provide a dose of effective vaccine recommended by WHO.
- If recommended provides the rabies immunoglobulin.

Rabies Control Challenges

It's difficult to defeat rabies because of the following factors:

- On public and veterinarian directions it is observed low.
- There are a number of stray dogs which are not vaccinated.
- Less literature about the dog ecology and population magnitude.
- Different kinds of wild species are possible source of rabies transmission.
- Less number of facilities for vaccination.

Economic Challenges

In a country economic price of rabies can be determined by pet animal immunization, animal bite inspection, quarantine facilities of pet animals which bite to humans or suspected with infection, animal officers package, laboratory diagnosis, community awareness program, training of staff and treatment strategies. The cost of all these programs for effective control of rabies is difficult to implement in the underprivileged countries.

Diagnosis Challenges

Rabies diagnosis is one of the important steps which perform to a veterinarian and sometimes it's difficult to diagnose in which exposure to human infection is strong. If any case of rabies occur in an area then it is not possible all the area have rabies infected animals due to

their nerve signs because after sometimes of infection it may changes. Rabies clinical inspection is much difficult in those areas where it's not familiar because sometimes it confused with other infection or aggressive behavior. The clinical diagnosis with negri bodies sometimes is not significant it just found 40 to 80 % in some rabies patients. Due to the lengthy incubation period and lack of specific early symptoms diagnosis of rabies is challenging.

Vaccine Challenges

One of the major challenges is costly Vaccine which everyone cannot access in underprivileged countries. There is also a chance vaccinated patient may develop neuropathy. In the severe cases its reaction to develop immunity is not immediate which ultimately cause the death of infected individual. One of the problem is inactivated virus vaccine may infect the vaccinated individual with rabies and also cause allergic reactions. It may also less effective in severe manifestation if the infected animal attacks on the face or neck to cause bleeding.

Stray Dogs

Third world countries are the possible source of urban rabies because they do not have rules to control stray dog due to some religious affairs as in India. It is estimated about 90% infection is exposure to rabid dogs and 99% human mortality in the world. The ratio of community dogs is very high in the Asian countries where stray dogs freely move in the community and their management level is totally based on the cultural or religion basis. In India almost 80% dog population belongs to community dog population. The number of community dog population is the possible factor for human to dog contact and also the source of rabies in humans.

Lack of Awareness

The community is not aware about the rabies infection and preventive measures. In some countries it is believed that lick of animal is the cure of wounds but it may be a source of rabies if the animal infected with rabies virus. In the developing countries many human mortalities occur which do not treat after exposure to the rabid dog. Almost 17 million victims of animal bites annually recorded in India. In Africa during the time of dog vaccination some kind of cultural and religious affairs impact the dog to human association which is also due to lack of awareness and which cause the possible source of rabies.

WHO Responses

- WHO guide the 'United against Rabies' to invest for rabies control to achieve the target of zero human mortality from dog rabid by 2030.
- WHO announced developing countries to designs their plan for rabies control and start campaign for the awareness of preventive measures against rabies.
- WHO routinely update about the recommendation on rabies like prevalence of rabies virus, diagnosis, and vaccination methods, less costly immunization and preventive strategies about rabies infection.

Table 1: Classification of contact and approved post-exposure prophylaxis (PEP)

Category	Contact with Rabid Animal	Post-exposure prophylaxis (PEP)
Category 1	Touching Feeding Animal lick on skin	No PEP, Washing of manifest skin
Category 2	Nibbling of exposed skin Slight scratches No bleeding	Washing of wound, Instant vaccination
Category 3	Single or numerous bites Scratched skin with saliva from animal lick	Washing of wound, Instant vaccination, Apply rabies immunoglobulin

(Source: WHO/Report Rabies/2020/04/21)

Table 2: WHO designed post exposure rabies vaccination method

Regimen	Interpretation	Days						
		(0)	(3)	(7)	(14)	(21)	(28)	(90)
Essen (IM 1 × 5)	O each of five visits one dose into deltoid muscle	1	1	1	1		1	
Zagreb (IM 2-1-1)	Double dose IM (1 dose at 2 sites) on day 0, followed by single doses on days 7 and 21	2		1		1		
Thai red cross (ID 2-2-2-0-1-1)	Double 0, 1 ml dose ID (1 dose at 2 sites) on days 0, 3, 7 followed by single doses on days 28 and 90	2	2	2			1	1
Oxford (ID 8-0-4-0-1-1)	Eight 0, 1 ml doses in separate sites on day 0, then four 0, 1 ml doses on day 7 (separate sites), then single doses at 28 and 90 days	8		4			1	1

Conclusion

Rabies is a viral disease and its epidemiology is occurring all over the world. Now it is a challenge for developing nations to eliminate the rabies globally. The current vaccine used for the rabies control is nervous genesis which has some side effects. Cultural and religious affairs in the developing countries for the management of community dogs and much expensive post exposure therapy are factors considered for global rabies infection. A number of mortalities observed in those countries with less public health facilities, lack of awareness, diagnostic potential, vaccination issues and no plan for elimination of rabies.

Recommendations

The elimination of rabies requires a sufficient and long term funding. Accessible vaccine must be upgraded, trained the professional for dealing rabid person and a long term awareness campaign, should be possible to achieve the target of WHO for the elimination of rabies by 2030.

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