

**EPIDEMIOLOGY OF ACUTE ENCEPHALITIS SYNDROME /JAPANESE  
ENCEPHALITIS A MOSQUITO-BORNE DISEASE IN GORAKHPUR DISTRICT**

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**Abstract**

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*Mosquitoes are carriers of various diseased pathogens. Poor drainage system grows population of mosquitoes which is mostly a problem of megacities. Japanese Encephalitis is the leading cause of viral encephalitis in various parts of world. Japanese Encephalitis has caused epidemics of several hundred to several thousand cases in Japan, Korea and Taiwan, and occurs in eastern Siberia, China, Okinawa, Jawa, Thailand, Malaya, Singapur, and India. Reports of a disease resembling JBE go back to 1871. The etiologic agent was characterized by Japanese workers during a severe epidemic in 1924. In 1958 there were 5700 cases with 1322 deaths reported in Korea, and 1800 cases with 519 deaths in Japan. In 1961, an outbreak in Taiwan involved 704 reported cases. Elsewhere (except in the mainland of China) the disease occurs as small outbreaks or sporadic cases. A vast range of fatality from 0.3 to 60 % depends upon different age group of the population. Mosquito borne Japanese Encephalitis was previously known as Japanese B Encephalitis which is a member of Flaviviridae. Generally transmission of animal diseases occurs by help of vector like mosquitoes. Mosquitoes are important vectors in the transmission of animal diseases. It involves the transmission of viruses, bacteria, fungi, Protozoa and Helminthiasis. Where major outbreaks occur, immunization of pigs could reduce*

*amplification of JBE virus and lower the infective level of Culex tritaeniorhynchus populations. In the present study, there are about 12 different species of the mosquitoes reported by the Malaria workers in different parts of rural and urban areas of Gorakhpur. Every year an outbreak of the 20 to 25 % mortality from the infected persons of AES/JE has been reported at the Gorakhpur.*

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**Key words:** Japanese encephalitis/Acute encephalitis syndrome, Culex, Gorakhpur.

### Introduction



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Mosquitoes are important vectors in the transmission of animal diseases. It involves the transmission of viruses and parasites from animal-to animal, animal-to-person, or person-to-person, without affecting the insect vectors with the symptoms of disease. Japanese encephalitis (JE) typically develops in patients after an incubation period of 5–15 days. It is possible that during this time, the virus resides and multiplies within host leukocytes, which act as carriers to the central nervous system (CNS). T lymphocytes and IgM play a major role in the recovery and clearance of the virus after infection (Bruce *et al.*, 1985). Viral infection to human is initiated by biting of female mosquitoes while carrying the active destruction of harmful loading of the concerned virus via immune system. Japanese studies indicate that the number of human cases is directly proportional to the density of this vector when an epizootic in pigs is in progress, and that the virus does not overwinter in this mosquito (Fukumiet *et al.*, 1975). Fluorescent antibody studies in *Culex tritaeniorhynchus* revealed that primary multiplication of the virus is in the posterior midgut epithelium, fat body cells and several other tissues support further multiplication, and the salivary gland cells become heavily and permanently infected. There is an experimental evidence of transovarial transmission in *Aedes albopictus* and *Aedes togoi* (Rosen *et al.*, 1978). The virus develops well in ovarian cell cultures of this mosquito (Hsu *et al.*, 1978). According to a study conducted during the year 1990-2000 revealed that total 43 new mosquito species were first time identified and documented out of 67 collected from Gorakhpur district, U.P. India. Among them the genus *Aedes* was represented by 15 species, *Anopheles* by 15, *Culex* by 24, *Mansonia* by 3, and *Mimomyia*, *Ochlerotatus*, and *Verrallina* by 2 each. The genera *Aedeomyia*, *Armigeres*, *Coquillettidia*, and *Uranotaenia* were represented by single species.

### **Historical and epidemiological perception**

The first outbreak of encephalitis recognized to Japanese encephalitis virus was reported in Japan in 1871. Major epidemics have been reported about every ten years; in 1924, over 6,000 cases were documented in a severe epidemic in Japan. (Miyake, 1964). In Uttar Pradesh major epidemic of Japanese encephalitis initiated from Gorakhpur in 1978 followed by 297 deaths out of 1002 cases accordingly. After 1978 many outbreaks of JE were reported with different intensity and magnitude followed by the most of death in Gorakhpur out of more 10000 lives in Uttar Pradesh (Kanojia *et al*, 2003).

### **Signs and symptoms**

Evident infection and mild systemic illness are frequent. The virus reaches the central nervous system (CNS) with the help of leukocytes (T lymphocytes) followed by the mosquito bite as an active vector which finally lead to JEV virions binding to endothelial surface of CNS and get internalized by the process of endocytosis. (Mathur *et al*, 1989). Cases developing in encephalitis have an onset of severe headache and vomiting; high fever and cerebral and meningeal involvement and transient ocular aberrations are frequent. Fatal cases usually undergo coma and die within 10 days. Convalescence is generally prolonged and accompanied by weakness, tremors, nervousness, and in coordination; permanent mental impairment and personality changes are known. Diagnosis of nonfatal cases is confirmed by a post-recovery rise in specific antibodies.

### **Materials and methods**

The data has been collected from Civil Hospital, Gorakhpur, private pathological laboratories/clinics of the Gorakhpur. The data are analyzed yearly since 2005 to 2013. Simultaneously different species of the mosquitoes reported in rural and urban areas of the Gorakhpur have been reported. The study area has been shown in the figure 1. The conclusions are made on the basis of observations and results.

### **Gorakhpur district overview**

An official census 2011 of district Gorakhpur of Uttar Pradesh shows the details as under the title urban population 2011. The details are revealed by directorate census operations of U.P.

### **Urban population 2011**

According to the census 2011 report 18.83 percent of present population resides in urban region of Gorakhpur district of total population including figures about 439,051 males and 397,078 females out of total population 836,129. Sex ratio reveals about 904 according to 2011 census. The child population under the six years age in urban population was 91,259 having 48,238 males 43,021 females respectively with 10.99 percent of the total population respectively. Literacy rate in 2011 of urban region of the district is about 82.39 percent in connection to 87.76 percent males and 76.46 percent females accordingly.

### **Rural population 2011**

Out of the total population of Gorakhpur districts more than 81.17 percent people reside in rural areas in figures 3,604,766 revealing 1,838,726 males and 1,766,040 females according to the census report of the year 2011 respectively. Sex ratio in the area is 960 females per 1000 males while in case of child it is 912 girls per 1000 boys of the age group 0-6 years revealing the total no in figures 537,183 followed by 281,014 males and 256,169 females contributing 15.28 percent of the total population. As for the literacy prospects it is 68.02 percent according to the census data 2011. In respect to the gender based literacy the rate prolong 80.30 percent males and 55.35 percent females respectively. Among the total population of 2,086, 628, the number of literate individuals were 1, 250, 910 male and 835, 718 females respectively.

### **Results and discussion**

The Acute Encephalitis Syndrome or Japanese encephalitis reported in the Gorakhpur are very much horrible. The poor drainage system waterlogging in rainy season in Gorakhpur is a ground for growing mosquitoes. In year 2005 the AES/JE was found to be horrible, about 997 have been suffering from the JE out of which 263 persons have died; this means about 26.37 % mortality have been reported within this small city. Though the advanced medical facilities are available still an outbreak is recorded every year, at 2006, out of 525 infected persons 99 patients were died. It is about 18.85 % in 2007, a total 114 were death recorded out of 758 infected persons. In 2008, 755 persons were suffered out of which deaths were 139. In 2009, total suffered were 749 out of which 145 were died. In 2010 total 997 were infected with the JE out of which 132 were died. In 2011 out of 931 suffered about 171 were died. In 2012 out of 775, 164 were died, it is found to be about 21.16 %. And in the table 1: from 01<sup>st</sup> Jan 2013 to 31<sup>st</sup> Dec 2013, Total

number of infected persons were 597 with this dreadful disease and 155 were died and it is about 25.96%. The data of nine years has been summarized in table 2. The year wise comparative description of sufferer and death in the Gorakhpur has been shown in the figure 2. The most common mosquito species found throughout the year in the Gorakhpur are

**Primary Vector:**

1. *Culex tritaeniorhynchus*
2. *Culex vishnui*
3. *Culex pseudovishnui*

**Secondary Vectors:**

4. *Culex bitaeniorhynchus*
5. *Culex gelidus*
6. *Culex whitmorei*
7. *Culex fuscocephalia*
8. *Culex quinquefasciatus*
9. *Culex epidesmus*
10. *Mansonia uniformis*
11. *Mansonia indiana*
12. *Anopheles subpictus*

Japanese encephalitis virus is maintained in mosquitoes and hosts other than man, the latter becoming accidentally involved. In major outbreaks the principle vector is *Culex tritaeniorhynchus*, which feeds mainly on large animals and birds. The disease occurs in warm weather in temperate regions; in the tropics it occurs in any season. In Japan *Culex tritaeniorhynchus* is the only mosquito consistently infect, a rural species that over winters as inseminated females and reaches maximum population size by late June.

Virus is frequently isolated from black-crowned night herons, egrets, and pigs. All these are amplifying hosts that serve to infect more vectors; horse infection is not of epidemiological importance because these animals experience a low and transient blood titer. Bats and *Culex vishnui* in bat caves were found infected with JBE virus in Taiwan (Cross *et al.*, 1971). Other vectors than *Culex tritaeniorhynchus* are six common species of *Culex* across the range of distribution of the disease, and also two *Aedes* in the Maritime province of the Soviet Union.

They have been occasional isolations from *Anopheles* mosquitoes. Where major outbreaks occur, immunization of pigs could reduce amplification of JBE virus and lower the infective level of *Culex tritaeniorhynchus* populations (Ueba *et al.*, 1972).

Surveys indicate that virus incidence and antibody conversion rates in pigs are high, and there are large vector populations, mosquito control measures could be applied to reduce the possibility of major epidemics in humans.

**Table 1: Acute encephalitis syndrome /Japanese encephalitis affected people in the Gorakhpur since 01<sup>st</sup> Jan 2013 to 31<sup>st</sup> Dec 2013**

| Sr. No. | Treatment Center                       | AES/J.E.Affected | Death |
|---------|--|------------------|-------|
| 01      | B. R. D. Medical College,<br>Gorakhpur | 530              | 150   |
| 02      | District (Civil) Hospital<br>Gorakhpur | 58               | 05    |
| 03      | Other P.H.C./C.H.C.                    | 09               | -     |
|         | Total                                  | 597              | 155   |

**Table 2: Acute encephalitis syndrome /Japanese encephalitis year wise comparative description affected people in the Gorakhpur**

| Sr. No | Years                       | 2005  | 2006  | 2007  | 2008  | 2009  | 2010  | 2011  | 2012  | 2013  |
|--------|-----------------------------|-------|-------|-------|-------|-------|-------|-------|-------|-------|
| 1      | Total sufferer              | 997   | 525   | 758   | 755   | 749   | 997   | 931   | 775   | 597   |
| 2      | Death                       | 263   | 99    | 114   | 139   | 145   | 132   | 171   | 164   | 155   |
| 3      | % Mortality                 | 26.37 | 18.85 | 15.04 | 18.41 | 19.36 | 13.24 | 18.73 | 21.16 | 25.96 |
| 4      | Total P.H.C.                | 19    | 19    | 19    | 19    | 19    | 19    | 19    | 19    | 19    |
| 5      | Total Affected Urban area   | 01    | 01    | 01    | 01    | 01    | 01    | 01    | 01    | 01    |
| 6      | Total Affected Rural area   | 655   | 375   | 510   | 513   | 543   | 718   | 660   | 594   | 448   |
| 7      | Total Affected Mohalla area | 83    | 50    | 80    | 80    | 66    | 61    | 69    | 58    | 46    |
| 8      | Total Suspected             | 55    | 62    | 98    | 80    | 26    | 20    | 40    | 73    | 11    |

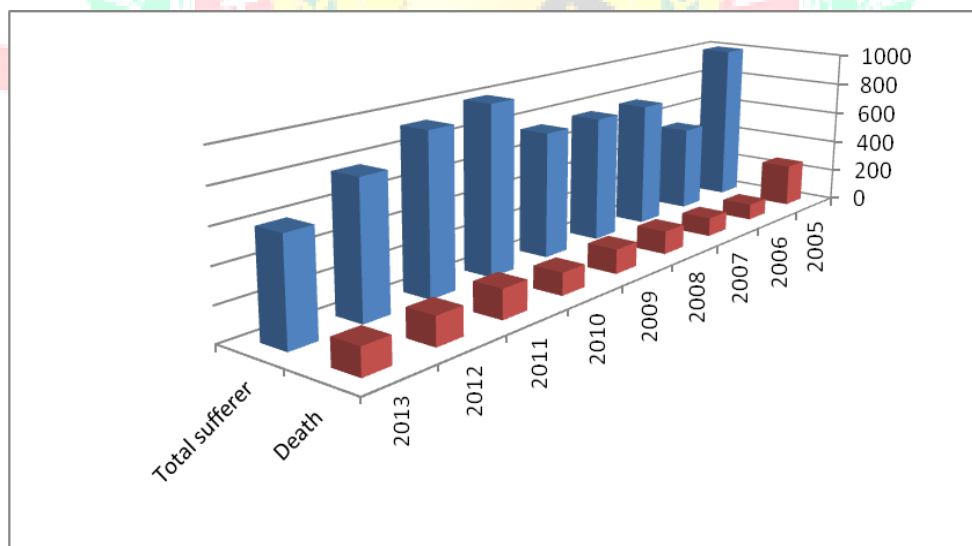


**Figure 1:**



Fig: Map showing location of study area, Gorakhpur in Uttar Pradesh of India.

**Figure 2: Acute encephalitis syndrome /Japanese encephalitis year wise comparative description of sufferer and death in the Gorakhpur**



### **Conclusion**

Gorakhpur city is situated on the plane plateau and has poor drainage systems which lead the accumulation of water in puddles generating natural breeding grounds to the mosquitoes. In winter and summer the populations of mosquitoes are found in large swarms. Thus protection from mosquito bites become difficult for inhabitants. Another difficult task is to make the local

reservoir (like birds, pigs, dogs etc) to make free from the infection of the viruses as they have become carriers of the same. Proper vaccinations at certain interval to the reservoirs may not be feasible which lead to various fatal diseases. There is no vaccine for this disease. In rural and slums of the district look lacks of personal cleanliness in the local citizens. People who are living below poverty line they ignore the suggestions given by the primary health centers of Gorakhpur.

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