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VIEW POINT

India's preparedness against yellow fever

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Abstract:

Yellow fever is an acute viral hemorrhagic disease caused by yellow fever virus belonging to flaviviridae family. Yellow fever is one of the notifiable diseases under the International Health Regulation. It was estimated that more than 0.2 million yellow fever cases with 30,000 deaths occurs annually across the world. Currently yellow fever is endemic to 44 countries and 110 countries are at risk category of yellow fever transmission. India, with largest susceptible populations, presence of vector in abundance and suitable environmental conditions will provide a fertile ground for yellow fever. As a yellow fever receptive zone and with high volume of International travel, India needs to take preventive measures against unwanted epidemics. Effective checking for valid yellow fever vaccination certificate at point of entry, regular entomological surveillance, expansion of yellow fever vaccination centres, generating public awareness and epidemic preparedness strategy are some of the steps against emergence of this fatal disease in India. Yellow fever hasn't entered into Indian territory till date but no stone should be left unturned to stop this disease from entering into the country.

Key words: Yellow Fever, Epidemic, Vaccine, Surveillance

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Introduction:

Yellow fever is an acute viral hemorrhagic disease, historically known as "yellow jack" or "yellow plague"[1]. It is caused by yellow fever virus (flaviviridae family) and mainly transmitted through bite of female Aedes mosquito.[2,3] The evolutionary origin of yellow fever was probably from Africa. It's spread to South America was assumed to be from slave trades in the 17th century.[4] Epidemic of yellow fever came into notice since centuries but first definitive outbreak in the new world was in 1647 on the island of Barbados.[5]Since then world had encountered many regular and devastating epidemics across Caribbean, Central and South Africa, South America etc.[6,7]

Yellow fever is one of the diseases notifiable under the International Health Regulation (IHR).[8] It was estimated that more than 0.2 million yellow fever cases with 30,000 deaths occurs annually across the world. Globally, 900 million people are at risk of yellow fever and among them 508 million are from African countries. Reduction of population immunity to infection, environmental changes, and population movement are some of the reasons of increase in number of yellow fever cases over the past two decades.[2] According to World Health Organization (WHO) currently 44 countries are endemic and 110 countries are at risk category of yellow fever.[9]Mostly African (31) and Latin American (13) countries are endemic to yellow fever but increase in international travel and presence of favourable environmental conditions also makes Asian continent vulnerable for the transmission. India, with large susceptible populations, abundance presence of vector and suitable environmental conditions provides a fertile ground for yellow fever. Rapid industrialization, booming economy and skilled manpower encourages international travels. Although no case has been reported till date from India but risk of transmission is always present and increasing. In the absence of any definitive treatment, India should take proper preventive measures to keep the land free from this deadly virus. This article tried to discuss the issues regarding yellow fever in India and give recommendations for future improvement.

Importance of yellow fever to India:

'Yellow fever receptive area', is an area in which yellow fever does not exist but where conditions would permit its development if introduced. [10] Favourable environmental factors like temperature (> 24° c), relative humidity (> 60%), presence of common monkey (Macacus rhesus and Macacus sinicus) and large susceptible population includes India under the Yellow

fever receptive area. 11Historically receptive areas had encountered transmissions of yellow fever virus. In 1996 jungle yellow fever virus was introduced from Brazil to United States of America (USA) and Switzerland because of International travel. Similar episode had occurred in 1999 from Venezuela to USA and Cote d'lvoire to Germany.[12] In the age of globalization, India encounters regular international travels through air, water and land from different endemic and non-endemic countries. So far, the spread of the virus has remained within the borders of endemic countries but there is always a possibility of quick spread of the virus causing epidemics in India.

Current status of Yellow Fever preparedness in India:

Surveillance at the Point of Entry:

Travel to any yellow fever non-endemic country from endemic country requires a valid yellow fever vaccination certificate. The vaccination should be done at least 10 days prior to arrival and it is valid for 10 years. Similarly travellers leaving non-endemic countries to the endemic countries are also advised to take yellow fever vaccine for their own protection. As a non-endemic country, all these rules and regulations are applicable for India. According to the guideline of International Health Regulation (IHR) 1969 & 2005, Air craft public health rules, 1954 & 2015 and Port health rules 1955 & 2015, India is conducting mandatory screening at points of entry (like airport, sea port etc.) for valid "yellow fever vaccine certificate".13,14,15 In spite of these obligatory checking, there was a recent case of traveller not having valid yellow fever certificate, allowed to visit his family members without completing the necessary period of quarantine in Bangalore.16 Such single lapse can be devastating as the traveller can be a case of yellow fever or in incubation period at the time of arrival. Such frauds make India even more vulnerable. Recently there was a diplomatic row between Nigeria and South Africa on the issue of fake yellow fever vaccination certificate.17 Similar cases had been reported form Tanzania, Zambia, Zimbabwe, Nigeria and many other African countries.18

Not only the travellers but also their mode of transport holds equal importance in transmission of yellow fever across the border. There were reported cases of "airport malaria: malaria acquired through the bite of an infected tropical anopheline mosquito by persons whose geographic history excludes exposure to this vector" in Europe and North America from the aircrafts travelled from malaria endemic countries.[19] Such instances for malaria can hold true

for yellow fever too. If appropriate procedure for fumigation and aerosol spray are not maintained in the aircrafts or ships, they can carry the infected mosquitoes. High volume of travel & transport with endemic countries, possibilities of errors cannot be ruled out. Even the unvaccinated cabin crews and in-transit international travellers may also go undetected if due precautions and care is not exercised.

There is documented evidence that yellow fever virus can be transmitted through trans-ovarial route in adverse conditions like extreme dry, absence of susceptible host etc.[20] So, there is possibility of silent entry of the virus from the incoming travellers and cargos from non endemic countries to India through land route.

Yellow fever as a biological warfare cannot be ruled out. Accusation against the British attempting to introduce yellow fever into India by infected mosquitoes from West Africa supports yellow fever as a weapon of bioterrorism.[21]Current political turmoil of India with its neighbouring countries may result in such kind of activities. So there is also requirement of careful & close monitoring at all international borders.

Entomological surveillance:

Surveillance is one of the important tools in prevention of disease. World Health Organisation had recommended "Aedes aegypti index" of <1 and a perimeter of 400 meters should be free from the breeding of insect vectors for airport and seaport. A report of entomological surveillance in few International airports of South India (1998-2004) has shown high vector index.20 This shows the inadequacy and under functioning of vector surveillance system and response.

Reservoir of yellow fever virus (common monkey) is present in almost every jungle of India. Uninhibited urbanization and deforestation increased the chances of human animal contact.[22] In depth biological studies of vectors and reservoirs for yellow fever is lacking in India. Such deficiencies in preparedness can cause catastrophic consequences.

Vaccination centres

World Health Organization (WHO) has recommended vaccine containing 17 D strain of yellow fever virus (live attenuated vaccine)for commercial use since last 80 years.[23]Single dose (0.5 ml) of yellow fever vaccine administered subcutaneously or intramuscularly will give lifelong

protection. Booster dose is only recommended for people living in non endemic countries every 10 yrs. Since the introduction of yellow fever vaccine in 1930s, more than 540 million doses have been administered and reported only few adverse events. Studies show that Yellow fever vaccine is cost effective, efficacious and safe vaccine. [24]

Government of India has established 27 yellow fever vaccination centres across India for providing yellow fever vaccine. (Table I) Out of the 27 centres seven are seaport and three are international airports.[25]Considering the vast geographical area (3,287,264 Km^2) and number of international travel (12 million/year) centres are very much inadequate.[26] Statistics from Ministry of Foreign Affairs showed that in the year 2013 more than 50 thousands have travelled to yellow fever endemic countries from India.27Scarcity of these designated vaccination centres are severe especially in eastern India. There was an incidence of yellow fever in a traveller after travelling to Brazil from United States in 1996. Brazil being a yellow fever endemic country, vaccination is always advisable before travelling. But in that specific case since nearest vaccination centre was 25 miles away from his home, he travelled without vaccination and contracted the disease.25India may face similar situations in future because of lack of yellow fever vaccination centres in close locality.

Table I: Distribution of yellow fever vaccination centres in India[25]

Sl. No.	States of India having Yellow fever vaccination centres	Number of vaccination centres
1	Delhi	6
2	Gujarat	5
3	West Bengal	3
4	Maharashtra	3
5	Tamilnadu	2
6	Goa	2
7	Uttar Pradesh	1
8	Kerala	1
9	Karnataka	1
10	Himachal Pradesh	1
11	Andhra Pradesh	1
12	Telengana	1

The inconvenience faced by the travellers because of scarcity of designated centres is not only the distance; they have to spend lot of money for staying overnight, wastage of time etc. Taking advantage of such inconveniences many private players came into existence. The cost of the vaccine in open market is ten times more than that provided by government designated centre

(Rs 300).[28] Ignorant travellers are rushing to these unauthorised centres for vaccination which ultimately increases their suffering. They, not only have to spend more money but also have to spend 6 days under quarantine because of vaccination from unauthorized centres.

Health care system preparedness:

Although a strong three tier health care delivery system is present in India since ages but it is plagued with shortage of manpower, lack of infrastructure, lack of monitoring and supervision with poor reporting system.[29] Infectious diseases still claim life in India unlike developed nations. In 2013, India had officially reported a total of 1964 outbreaks from different age old diseases like acute diarrhoeal diseases, enteric fever, viral fever etc. New diseases like swine flu, Crimean Congo hemorrhagic fever, scrub typhus etc were making their way into the picture.[30] In present state, health care delivery system is unable to detect, report, and take preventive action against the ongoing outbreaks. Recent outbreak of Ebola in African countries showed how a new emerging disease can have devastating effect on health system.[31]Similarly emergence of fresh diseases like yellow fever in India can put severe pressure on the existing health system.

Research

There are a lot of unaddressed questions related with yellow fever in the world and specifically in India. Why yellow fever is absent in India in spite of favourable condition? What is the level of cross protection among different arbo-viral diseases? Is there any difference between Aedes aegypti mosquito found in India and Africa? Is Indian race giving any level of protection against yellow fever?[11]Addressing these unaddressed questions with well constructed epidemiological, entomological and clinical research will pave the path for prevention and control. Present scenario shows India's apathy towards yellow fever related research.

Recommendations:

Several modifications are needed for strengthening of prevention & control strategies in India. First: historically India had separate national programs for each vector borne disease prevalent in the country. In 2003-04 government has merged six vector borne diseases looking at the common mode of transmission and prevention & control strategy.[32]Yellow fever being a vector borne disease has not found a place in the national program. Although yellow fever is not present in the country till date but strong policy level decision and it's mainstreaming in the

ongoing program beforehand will help in strengthening the prevention and control strategies. Second: strengthening of surveillance at every point of entry whether air or land or water and carrying out effective vector control strategies at port areas. Third: strict enforcement of law like following period of quarantine stringently and mandatory yellow fever vaccination for those leaving India to endemic countries. Fourth: According to International Health Regulation, yellow fever vaccination can only be done in selected vaccination centres recommended by WHO or national health authorities. So, expansion of the number of yellow fever vaccination centres is demand of the hour. India has the potential to expand yellow fever vaccination as there are more than 380 Government medical colleges recognized by Medical Council of India (MCI) spread over all the states across the country.[33] All these medical colleges with well established infrastructure and manpower for routine immunization can serve the potential site for new vaccination centres. It will not only reduce the chances of unvaccinated travelling to endemic countries but also reduces the financial burden and unanticipated difficulties faced by travellers. Fifth: Generating health awareness through countrywide mass media campaign, health talk and other awareness generating programme regarding the yellow fever disease and its control strategies. Sixth: Taking some precautionary measures like training the health manpower, stock piling of vaccine and agreement with international organization for rapid supply of vaccines in emergency, separate fund for research activity on yellow fever will help India to avoid disastrous situation.

Conclusion:

Yellow fever hasn't entered into Indian Territory till date. Scientists have different assumptions on the absence of the yellow fever virus in this part of the world without any strong evidence. Although preventive vaccination among the travellers visiting the endemic country is one of the strongest ways to prevent the international spread of the disease but other cost effective strategies should not be overlooked. Strong political will and effective preventive measure can safe guard India to fight against this virus. Since India has been categorized as "Yellow fever receptive area", no stone should be left unturned to stop this disease from entering into the country.

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