

RESEARCH ARTICLE

COVID-19 EPIDEMIOLOGY AND COMPARATIVE EVALUATION OF SARS-COV-2 WITH SARS-COV AND SPANISH FLU

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Manuscript Info	Abstract
<i>Manuscript History</i> Received: 15 September 2020 Final Accepted: 18 October 2020 Published: November 2020 <i>Key words:-</i> COVID-19, SARS-CoV-2, WHO, CDC	We are in the middle of a pandemic of COVID-19. Objective of the study is to study the epidemiology of SARS-CoV-2 in India and its comparison to SARS-CoV and Spanish flu. Data used are primarily obtained from Worldometer, WHO and CDC. We have plotted bar and line charts based on MS-Excel.Comparative evaluation of COVID-19 data of India and World has been done which shows that with COVID-19 containment and mitigation strategy the total number of recovered patients is increasing day by day and surpassing total number of active infection in India as well as world.With continued non-pharmacological measures like social distancing, hand hygiene, judicious use of mask and effective lockdown, would definitely prove helpful in battle against COVID-19.
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Introduction:-

In the year 2019 a novel corona virus (which was later named as SARS-CoV-2 by WHO) originated in Wuhan, China December 2019, where a cluster of unusual respiratory illnesses which was dominated by pneumonia were first reported (1). After its origin which was supposed to be from bat soup in wet markets of Wuhan, it began spreading globally. On 11 march 2020, WHO declared it a pandemic and named the disease as COVID-19 (Corona virus disease, originated in 2019) (2). With the very beginning of twenty-first century, world has experienced the emergence and outbreak of previously unidentified coronaviruses: severe acute respiratory syndrome coronavirus (SARS-CoV) in 2003, Middle East respiratory syndrome coronavirus (MERS-CoV) in 2012, and in 2019 SARS-CoV-2. All belong to the Coronaviridae family of viruses which possess a positive-sense single-stranded RNA genome. Although SARS-CoV-2 and SARS-CoV are genetically and structurally related, but SARS-CoV-2 has its own unique features that is responsible for its rapid spread around the globe (3).

In the absence of any definitive treatment strategy and vaccination; hand hygiene, social distancing and complete lockdown are the only measures for control and mitigation(4). But the effect of social distancing and lockdown will depend very much on the age structure of the population, requirement of the population and most importantly its duration. SARS-CoV-2 epidemiology can also be compared to the previous outbreak of SARS-CoV. So in this study, an epidemiological comparison is done based on data of WHO (World health organisation) and CDC (Centre for disease control and prevention) to see the impact of lockdown on COVID-19 epidemiology in India.

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Method:-

This analysis is based on current COVID-19 data available on Worldometer.info regarding world, USA and India which was accessed on 22^{th} June 2020 (5). Regarding SARS-CoV (2002-03), the data was obtained from WHO and CDC(6)(7). It is based on simple mathematics with formation of bar chart and line chart formed on MS excel.

Result:-

Epidemic Structure:

On 11th March 2020 (WHO declared COVID-19 as pandemic), World had a total number of 126,215 cases, USA had 1301 cases and India had 62 cases. On 22nd March 2020, India had seen a Janta Curfew and from 23rd March 2020 a complete lockdown till 14th April with the exception of essential services. Lockdown (Lockdown 2.0) was further extended to 3rd May in view of increasing number of cases. After 3rd May, Lockdown (Lockdown 3.0) was again extended till 17th May with some relaxation. Then, since 18th May, Lockdown 4.0 started till 31st May, in this period shops were allowed to open on alternate basis with shopping malls, religious places and recreational centres still closed. During the lockdown period, on a largescalelabours started to return from their working place to their native village creating large scale displacement and further increasing risk of transmission of COVID-19 infection. Further, a number of religious activities were also conducted which also leads to the failure of lockdown. Since 8th June, unlock 1.0 started, in which all the shops, restaurants and religious places were allowed to open with precautions, as India being a developing country cannot afford to close its economy for such long duration.

As of 22^{nd} June 2020, a total of 213 countries and 2 international conveyances around the world are infected which accounts for a total number of 9.05 million people. Out of this 4.8 million recovered and approximately 0.47 million died (figure no.1). India being 2^{nd} most populous country in the world, with approximately 0.4 million cases and 13,000 deaths (figure no.2).Still cases in India are increasing at a rate of approximately 15,000 new cases daily and it is likely that it may surpass USA in terms of number of total number of cases(8).

As depicted in the figure no.1and 2, it is quite obvious that total number of cases are further increasing and the peak number of cases are still to achieve. As COVID-19 has got a R0 value to 1.4-6.49, it has got a high reproduction rate. But , the good thing about the present scenario is that the total number of recovered patients continue to increase, even surpassing total number of active cases somewhere near to end of May. This is a very promising sign that with this continued trend the number of recovered patients will be far more than number of active cases and this will eventually lead to larger population of immune persons. This trend will eventually lead to end of pandemic as more and more people continue to recover. Same is the case with India, but surprisingly very low mortality rate as compared to world.

Comparison with SARS-CoV:

There are a lot of similarity between SARS-CoV and SARS-Cov-2 genetically, pathogenically and epidemiologically. The genetic sequence of SARS-CoV-2 is found to be \geq 70% similar to that of SARS-CoV. Both are capable of using the same cell entry receptor (ACE2) to infect humans (9)(10). However the difference is in the key S protein, due to which SARS-CoV-2 spike binds to ACE2 of humans with approximately 10-20 fold higher affinity than that of SARS-CoV spike (11). All these factors lead to a higher R0 value for SARS-CoV-2 as compared to SARS-CoV.Till now WHO has estimated a mortality rate of 3.4% for SARS-CoV-2 which is far less than SARS-CoV (9.62%). But due to higher R0 value, former is more infectious than the later and the has more person-person transmissibility which led to this pandemic. Hence, in order to contain and mitigate the ongoing pandemic of COVID-19, non-pharmacological intervention should be implied strictly, until vaccine and definite medications arrive in the market.Table no.1 shows the comparison between SARS-CoV and SARS-CoV-2. Epidemiological picture of SARS-CoV has been plotted on figure number 3 and 4 for which the data has been obtained from WHO and CDC (6)(7).

Comparison with Spanish flu:

As compared to 1918-1920 Spanish flu pandemic, the COVID-19 pandemic shows a lot of similarities. Although Spanish flu pandemic was caused due to Influenza A (H1N1) and its R0 value ranges from 1.7-2.8. Most commonly affected were children and pregnant females while in case of COVID-19, susceptible as most commonly elderly age group and persons with co-morbidities. The mode of transmission was respiratory and fomite borne as with the case of COVID-19 (Table no 2). Transmission of Spanish flu was mostly due to migration of military troops at the time

of World war 1. It is said that casualties due to Spanish flu was much more as compared to World War 1. At that time vaccine or definitive treatment was not available. But Spanish flu was much more deadly as it took 50 million lives at that time, although definite data is not available about case fatality rate. The preventive measures taken at that time was same like todays such as use of mask, social distancing, hand hygiene and lockdown (12).

Discussion and Conclusion:-

In India, up to 21st March 2020; there were 283 confirmed cases and four deaths and it was mostly from international travellers(13). At that time some cluster of cases among family members were reported but till that time there was no community transmission. In order to contain SARS-CoV-2 cases in India, government of India had started several measures including rigorous thermal screening at various international airports, a number of major and minor seaport and land crossings for early detection of cases(14).

In the absence of definite medical treatment and vaccination, the only approach left is non-pharmacological like hand hygiene, social distancing and lockdown. Due to the implementation of timely lockdown from 23rd March in India, initially the steep rise in number of cases was not seen unlike USA. Although, in USA lockdown started from mid-march, it was not complete lockdown and hence the number of cases still continued to rise with a mortality rate of 5.18%. While, in India mortality rate is 3.20% which is quite low as compared to USA, due to earlier effective lockdown measures. But due to certain factors like religious gathering, lack of proper follow up and migrant labour displacement, India could not contain the spread of SARS-CoV2 and total number of infected personcontinued to rise and now reaching 0.4 million cases and became 4th most infected country in the world.As predicted by ICMR (Indian Council of Medical Research), India might see peak in total number of cases in the month of June- July. As evident from figure number 1 and 2 of trends in COVID-19 in World and India respectively that the line representing total number of recovered patients surpass line representing total number of active cases which is a very good sign from epidemiological point of view. These figures showed that with this continued trend the total number of recovered patients will be very high as compared to the total number of active cases in the near future and this trend will eventually mark the end of the pandemic.

SARS-CoV-2 primarily spread by droplets and can spread both through symptomatic and asymptomatic cases(15). Eighty percent patient infected by COVID-19 have very minimal or mild symptoms not requiring hospital admission (16). WHO had released a guidance on March 3, 2020, which includes four phases: containment, delay, mitigation, and research for the better understanding of COVID-19 and its effects, and also to address the challenges faced during imperfect diagnostic approaches and absence of authentic treatments or a vaccine(17). For containment and delaying various social distancing strategies like preventing use of public transport, cancellation of conferences and other large gatherings, and closure of schools were already in place. But now mitigation approaches are required as we are already in stage 3 of epidemic. A number of mitigation approaches are there to slow further spread of SARS-CoV-2 pandemic like to expand testing capability and increase hospital capacity, reduction in the anticipated surge in health care use, provide COVID-19 patients with right level of care in order to maximize time limited home isolation and proper isolation facilities to reduce transmission. Following clinical trials are currently underway based on -inhibiting RNA-dependent RNA polymerase (Remdesivir, Favipiravir), Inhibiting viral protease (Ivermectin, Lopinavir/Ritonavir), blocking virus-cell membrane fusion (Hydroxychloroquine), enhancing innate immune system, attenuating inflammatory response (Intravenous Immunoglobulin, SARS-CoV-2-Specific Neutralizing Antibodies, Anti-C5a Monoclonal Antibody) and vaccine (mostly based on the S protein-coding sequence)(18). Recently Drug controller general of India (DGCI) had approved Fevipiravir, for the treatment of mild and moderate cases of COVID-19. Above discussed measures and research will definitely prove helpful in our battle against COVID-19.

Earlier various models have been approved by ICMR and WHO, which was SEIR (susceptible, exposure, infection and recovery) model and predicted that with continued lockdown the number of active cases will keep on decreasing and eventually the we will recover from the pandemic. But in the present scenario, all the mathematical models failed. A number of factors may be responsible for failure of mathematical model like high R0 value of SARS-CoV-2, failure to implement complete lockdown, a number of societal factors leading to mass gathering, increased number of testing and many more. Although, the model was made in an ideal situation where there was perfect lockdown, social distancing, hand hygiene and judicious use of mask; which is not possible in real world.

The main focus of our analysis was towards studying the epidemiological effect of COVID-19 pandemic in India. As discussed earlier continuous lockdown has proven to be an effective measure in reducing the spread of COVID-

19 but could not be implemented for long duration. The above comparisons also cement our observations. In the absence of definite medical treatment and vaccination, the only approach left is non-pharmacological like hand hygiene, social distancing and judicious use of mask.

Table:

 Table no 1- Comparison of the epidemiological, clinical and radiological features of the diseases caused by SARS-CoV and SARS-CoV-2:

	SARS-CoV	SARS-CoV-2
Disease	SARS	COVID-19
Transmission	Respiratory droplets	Respiratory droplets
	Close contact	Close contact
	• Faeco-oral	• Possibly faeco-oral (12)
	• Aerosol (11)	Possibly aerosol (13)
Incubation period	2–7 days	2-14 days (14) (15)
Contagious period	10 days after onset of disease	Unknown
Reservoir	Bats	Bats
Basic	2-5	1.4- 6.49 (16)
reproduction		
number (R0)		
Origin	Guangdong, China	Wuhan, China
Fatality rate	9.62%	3.4%

 Table no 2- Comparative evaluation of SARS-Cov-2 and Spanish flu:

	COVID-19	Spanish flu
Causative agent	SARS-CoV-2	Influenza A (H1N1)
Area of Origin	Wuhan, China	Unknown
Estimated R0	1.7-2.8	1.4-6.49
Age group most commonly affected	Elderly	Adult and Pregnant

Figure:











Figure no. 3- Epidemiology of SARS-CoV 2002-03





Conflict of Interest:

Authors declare no conflict of interest.

Ethical clearance:

Not needed

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