Epidemiology: Open Access

Mini Review Open Access

Epidemiology and Vaccine for Respiratory Syncytial Virus

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Abstract

Lower respiratory tract infections in young infants and the elderly have been linked to the respiratory syncytial virus (RSV). It is a negative-sense RNA virus with an envelope from the genus Orthopneumovirus. RSV infection symptoms might range from otitis media or mild upper respiratory tract diseases to serious lower respiratory tract infections. According to recent estimates, 33.1 million episodes of RSV-acute lower respiratory infection (ALRI) in young children occurred in 2015. The bulk of these episodes, or around 30 million, occurred in low- and middle-income countries. In numerous hospital- and community-based investigations conducted primarily on children in India, the rates of RSV detection range from 5% to 54% and from 8% to 15%, respectively. RSV outbreaks begin in the South and move to the North on a global scale. In RSV primarily peaks in North India during the winter, and there has been some association with low temperatures. India has produced several genotypes of Group A (GA2, GA5, NA1, and ON1) and Group B (GB2, SAB4, and BA). RSV continues to be a top priority for vaccine research due to its widespread prevalence. There is still no licenced vaccine, despite nearly 50 years of attempts, and the scientific community continues to face difficulties in developing a vaccine that is both safe and effective. Using the keywords RSV, epidemiology, and India, the data for this review were collected from PubMed. The authors have combined the information.

Keywords: Acute respiratory infection; Acute respiratory infection; epidemiology; Respiratory syncytial virus

Introduction

One of the most significant causes of lower respiratory tract infections (LRTIs) in young infants and the elderly has been identified as respiratory syncytial virus (RSV). It is one of the most major childhood infections and is linked to high rates of morbidity and mortality, particularly in low- and middle-income countries (LMIC). The RSV vaccine has not progressed as quickly as it should have despite the significant illness burden caused by RSV to date. However, a number of RSV vaccines and monoclonal antibodies are currently being developed because to improvements in immunopathology research and immunogenic design in recent years [1]. Before a vaccine is introduced, it is crucial to understand the epidemiology of an infectious disease, which is why there has been an increase in research on this topic globally research on the epidemiology of the RSV have included India. This paper provides an overview of the data on RSV epidemiology in India. RSV is a family Pneumoviridae, order Mononegavirales, and genus Orthopneumovirus enveloped negative-sense RNA virus. About 15200 nucleotides of the unsegmented RNA code for 11 structural and non-structural proteins. Glycoproteins G, F, and SH are found in the envelope, with G protein serving as the cell-attachment protein and being the most variable. The fusion protein, or F protein, causes the formation of syncytia [2]. Neutralizing and non-neutralizing antibodies are produced by both G and F proteins. The virus is split into two main antigenic groupings, Group A and Group B, based on the reactivity of RSV with monoclonal antibodies against G glycoprotein [3].

Clinical Features

Clinical manifestations of RSV infection might range from otitis media or moderate upper respiratory tract diseases to serious lower respiratory tract illnesses. The most common cause of LRTI, which includes bronchiolitis, pneumonia, and occasionally croup, is RSV, especially in young infants under 1 year old. 50% of children are infected with this virus within the first year of life, and 20% to 40% of those children exhibit LRTI symptoms (bronchiolitis or pneumonia) [4]. The virus replicates in the Nasopharynx initially before spreading to the lower respiratory tract; its incubation period is three to five days, and both children and adults are susceptible to reinfections. Wheeze, chest tightness, tachypnea, and crepitation symptoms were far more likely to be present in RSV positive patients than in RSV negative patients. Underlying health issues, such prematurity, an elevated risk of RSV hospitalisation and fatality is linked to congenital heart disease or chronic lung disorders. According to a meta-analysis of risk factors for RSV, crowding, low birth weight, smoking by the mother, history of atopy, male siblings, and prematurity are all strongly linked to RSV-associated acute lower respiratory infection (ALRI). Unless underlying risk factors are present, such as frail elderly people living at home or in long-term care facilities, underlying chronic pulmonary disease or circulatory disease, and the severely immunocompromised, RSV infections in adults are typically secondary infections and are mild to moderate in severity [5]. Immunocompromised and post-transplant patients are more susceptible to serious infections. Compared to the general population, transplant recipients have a much greater mortality rate from RSV. Haematopoietic stem cell transplant recipients (7.3%, 60-day mortality), recipients of solid organ transplants (13.3%, 60-day mortality), and patients with chronic obstructive pulmonary disease (12.8%, 60-day mortality) all experienced significant morbidity and mortality in a 2-year retrospective study in RSV-positive patients [6].

Global Respiratory Syncytial Virus Epidemiology

The top causes of illness and mortality in children under the age of five worldwide are ALRI. One of the most frequent pathogens found in children with ALRI is human RSV. According to a recent meta-analysis, there were approximately 33.1 million episodes of RSV-ALRI

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in young children in 2015; the majority of these, or about 30 million episodes, occurred in low- and middle-income (LMIC) countries, with about a third of those episodes occurring during the first year of life [Figure 1]. In contrast, there were only an estimated 2.8 million RSV-ALRI episodes in high-income countries (HIC), meaning that the burden of RSV was more than ten times higher in LMIC and About 3.2 million (2.7-3.8) hospital admissions and 59,600 (48,000-74,500) in-hospital mortality in children under the age of five were caused by RSV-ALRI. When compared to children aged 5 years and older, babies had a two- to three-times higher risk of severe RSV-ALRI. RSV-ALRI caused 27,300 (UR 20,700-36,200) in-hospital deaths in children younger than 6 months, 1.4 million (UR 1.2-1.7) hospital admissions, and a substantial percentage of those deaths occurred in newborns who frequently come with apnoea or sepsis [7].

Acute Respiratory Infection

One fifth of India's 2.5 million annual infant deaths are attributable to ALRI. ARI causes between 17% and 25% of all under-five fatalities, and its fatality rate in rural India is roughly 27/1000. According to estimates, ARIs are to blame for 20% to 40% of all outpatient visits and 12% to 35% of indoor admissions. 3.67 attacks per kid per year in under-fives from rural communities around Delhi were assessed to constitute ARI rates, with 14.7% of those attacks being ALRT [8]. RSV detection rates in several hospital-based investigations, which were largely performed in children, range from 5% to 54%. These variations in RSV detection rates are brought on by patient selection, age group, and RSV diagnosis technique. The majority of recent investigations that have using molecular methods reveal rates ranging from 15% to 22%. However, studies using immunochromatography or ELISA antigen detection methods show a relatively high rate of RSV detection, which may be because to the high false positivity of these techniques. According to a study done at AIIMS, New Delhi, a sizable portion of LRTIs in children under the age of five in India (44.5%) are caused by viral infections. RSV was found in Centrifugation-enhanced culture found ALRI in 17% of the children hospitalised with it. RSV was a serious pathogen 26% of cases of bronchiolitis in children [9].

In these Ballabhgarh community studies, the incidence rates of RSV infection were 234 .1000 child years and 420 (350-500)/1000 child years in Krishnan's later study. The real-time reverse transcription-polymerase chain reaction (PCR) was utilised in the subsequent investigation in place of the immunofluorescence assay (IFA), which may be the reason for the higher rates observed there. In the study of Brooret, babies had the greatest incidence rates, 324/1000 child years. The incidence of severe RSV-associated ALRI is estimated to be 75 (31-180)/10,000 child years globally. The average yearly incidence of RSV-related hospitalization/1000 child years from Ballabhgarh was 7.4 compared to 0.5 among children aged 24-59 months, indicating that the majority of the burden falls on the youngest age groups [10].

Molecular Epidemiology

Only a few studies from India have looked into RSV's molecular epidemiology [11]. These included RSV detection in clinical samples utilising cutting-edge diagnostic technologies including real-time PCR and PCR-PCR. DNA sequencing was used to characterise the RSV strains, and phylogenetic, Bayesian, and network analysis were conducted after that. By using phylogenetic analysis, the RSV strains were divided into genotypes. There have been reports of both Groups A and B RSV in India. India has produced several genotypes of Group A (GA2, GA5, NA1, and ON1) and Group B (GB2, SAB4, and BA) [12].

Conclusion

The G gene exhibits 60 bp duplication in the BA genotype of Group B and 72 bp duplication in the ON1 genotype of Group A.

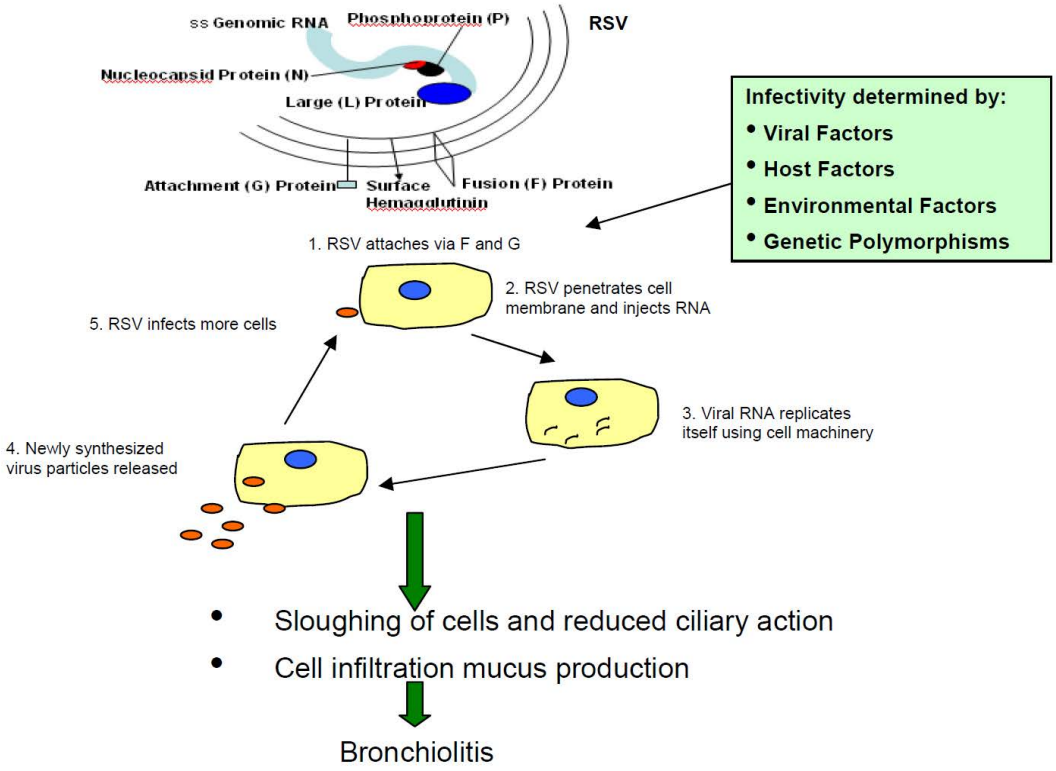

Figure 1: Epidemiology of Respiratory Syncytial Virus.

Evolutionary rates and the time to the most recent common ancestor were calculated. The burden of RSV globally has kept it a high priority for vaccine development. After nearly 50 years of attempts, there is still no licensed vaccine and challenges to obtain a safe and effective vaccine is still facing the scientific community.

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