AFRICAN JOURNAL OF MEDICINE and medical sciences

VOLUME 24, NUMBER 1, MARCH 1995

EDITOR: B.O. ONADEKO
ASSISTANT EDITORS:
B.O. OSOTIMEHIN and A.O. UWAIFO

SPECTRUM BOOKS LIMITED
Ibadan • Owerri • Kaduna • Lagos

ISSN 1116—4077

Afr. J. Med. med. Sci. (1995) 24, 1-7 *Review Article*

Viral respiratory infections and their role as public health problem in tropical countries (Review)

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Summary

Acute respiratory infections (ARI) are a major cause of morbidity and mortality throughout the world. Data from the World Health Organization indicate that there are at least 2.2 million deaths from ARI throughout the world each year. A considerable number of study have been performed in different countries to assess the etiological role of viruses in ARI and is now clear that the majority of infections of the respiratory tract are caused by viruses.

In tropical countries information on the viral etiological agents of ARI is rather scanty. Nevertheless data from Papua New Guinea, Polynesia, India, Pakistan and Singapor show that influenza occurs frequently in tropical countries. The other respiratoıy viruses especially respiratory syncytial virus, parainfluenza viruses and adenoviruses also play significant role as etiological agents in many tropical countries as Panama, Jamaica, Brazil, Colombia, Trinidad, Uganda, India and Nigeria. The data concerning seasonal prevalence of viral ARI in tropics are contradictory.

Résumé

Les infections respiratoires aigües (IRA) sont la cause majeure de la morbidité et de la mortalité à travers le monde. Des données de l'Organisation Mondiale de la Santé, il résulte qu'il y a au moins 2,2 millions de décès causés chaque année, par les IRA, à travers le monde.

D'importantes études ont été menées dans différents pays pour évaluer le rôle étiologique des virus dans les IRA, et aujourd'hui, il est clair que la majorité des infections des voies respiratoires, est causée par des virus.

Dans les pays tropicaux, les informations sur les agents étiologiques, sont peu abondantes. Toutefois, des données en provenance de Papouasie Nouvelle Guinée, Polynésie, Inde, Pakistan et Singapour, montrent que la grippe frappe souvent dans les régions tropicales.

Les autres virus respiratoires, notamment: le virus respiratoire syncytial, les virus paragrippaux et les adénovirus jouent aussi un rôle important tout comme les agents étiologiques, dans de nombreux pays tropicaux tels que la Panama, la Jamaïque, le Brésil, la Colombie, Trinidad, l'Ouganda, L'Inde et le Nigéria. Les données relatives à la fréquence saisonnière des IRA dans les zônes tropicales, sont contradictoires.

Introduction

Acute respiratory infections (ARI) are a major cause of morbidity and mortality throughout the world. ARI include infections of viral and bacterial origin, such as the common cold, pharyngitis, laryngitis, tracheitis, bronchitis, pneumonia and bronchopneumonia. Data from the World Health Organization (WHO) indicate that there are at least 2.2 millions deaths from ARI throughout the world each year[1,2]. In developed countries among infants and those over 65 years of age, such infections are responsible for 10-15% of deaths. For developing countries, available data indicate that although the morbidity from ARI is roughly the same as in developed countries, the associated mortality may be 30 or more times higher[3], however, for most developing countries data of mortality and causes of death are not available.

Most data on ARI come from studies conducted in temperate areas. The little information that is available shows a leading role of ARI in the tropics and subtropics. In a review of infectious diseases in Angola[4] influenza was found to be the third major cause of illness, preceded by malaria and "acute

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intestinal disease of unknown etiology"

About one-third of all paediatric admissions to hospitals in Panama City (Panama) are due to AR diseases[5]. From 1970 to 1979 at Goroka Base Hospital, in Papua New Guinea, pneumonia was responsible for 29% of the paediatric admissions, and for 31% of the deaths of children in the hospital[6].

Information concerning the situation in Nigeria shows a similar picture. Data from University College Hospital, Ibadan show that 10.4% of all admissions for one year period are patients with respiratory diseases excluding tuberculosis[7]. Osuhor and Etta[8] carried out a morbidity survey in Samaru, Zaria, among 399 children under 5 years of age. The 3 commonest ailments were respiratory diseases - 25.1%, protein-calorie-malnutrition - 21.1%, and gastroenteritis - 15%. The majority of the infections were in infants - 57%, while only 8% were aged 3-5 years. Obi[9] analysed paediatric medical cases admitted to the Children's Clinic, Benin City. The commonest infections were enteritis - 23%, respiratory infections - 23.3%, and malaria - 21.7%. Warrel[10] reported lobar pneumonia as the commonest cause of hospital admissions in Zaria. The analysis of medical admissions to paediatric ward of the General Hospital Lagos[11] during one year period shows that the largest group, accounting for 20.9% of all admissions and 19.3% of all deaths, suffered from diseases of the respiratory tract, excluding tuberculosis and measles bronchopneumonia. A study carried out in Adeoyo Hospital, Ibadan[12] shows that 23% of total admissions of the children under the age of 10 years were patients with lower respiratory tract infections (LRTI), with mortality rate 32.2%.

Odiase[13] investigated the leading causes of death among in-patients of the University of Benin Teaching Hospital in the year 1974, pneumonia was into the 10 diseases responsible for 73.3% of the deaths. Sofowora and Onadeko[14] reported a death rate of 20% from Nigerian patients with pneumonia. In another study[15] the mortality due to respiratory infections in Nigerian children was found to be 19% of all admissions in Lagos.

Etiological agents of viral respiratory infections

Many studies have been carried out to establish the relative importance of the microbial agents involved in respiratory tract infections. The 3 major types of respiratory pathogens are bacteria, viruses and mycoplasmas. Although bacteria can produce significant diseases of the respiratory tract, it has been possible to establish them as causative agents in only small proportion of such illnesses. A number of studies have been performed in different countries[16,17,18,19,20,21,22] to assess the etiological role of viruses in ARI. The majority of infections of the respiratory tract are caused by viruses. Almost all studies support this premise[23,24]. Viral agents have been estimated to be responsible for over 90% of cases of upper respiratory tract infections (URTI), and a considerable, if lesser proportion of cases of LRTI[25]. Respiratory syncytial virus (RSV), parainfluenza (PI) viruses, adenoviruses and influenza viruses have been found to be the most important agents[26,27,28,29]. Rhinoviruses have also been found to be important pathogens although they normally cause mild diseases[30,31,32]. The role of coronaviruses and reoviruses is not so important. Generally they cause URTI[33,34,35].

Respiratory viruses in the tropics

Most of our knowledge on the etiological agents of viral ARI is derived from observations in the temperate zone, where viral infections predominate. In tropical countries, information on the viral etiological agents of ARI is rather scanty, because of the lack of laboratory facilities and epidemiological data. It is of interest to compare various aspects of viral ARI in temperate areas and the tropics.

Incidence of viral ARI

Data from Papua New Guinea[36], Polynesy[37], India[38,39], and others show that influenza occurs frequently in tropical countries where the prevalence of individual virus variants is not substantially different from that in the countries with temperate climates[40]. Serological survey of influenza in Pakistan during period 1976-1980[41] established that 36% of the population had antibodies to influenza B virus and 89% to influenza.A virus.

Influenza surveillance in Singapore, during 1972-1986[42] shows that influenza is one of the major viral diseases on the island of Singapore and outbreaks due to influenza A virus occurred every year and to influenza B virus at intervals of 16 to 24 months.

During the course of continuous surveillance of

influenza in 1980 in Pune, India[43] three outbreaks of ARI were noted. The first and second outbreaks were associated with influenza A and B viruses.

In a study carried out in Ahmadu Bello University Teaching Hospital, Zaria[44] sera from 13 adult patients with lobar pneumonia were tested for antibody to several respiratory viruses. Influenza A infection was confirmed in 3 patients (23%).

The other respiratory viruses also play significant role as etiological agents of ARI in the tropics[45,46,47]. In a serological survey in the Caribbean Island of Jamaica[48] during a 30 month study period, specimens from 552 patients of all age groups, suffering from some from of respiratory illness were examined. Serologic findings indicated influenza A virus in 5.7% of the cases, influenza B virus -3.2%, influenza C virus -2%, PI virus type 1 -8.3%, PI virus type 3 -7.8%, adenoviruses -4.1% and RSV -8.6%.

During a 4 year period of observation ARI was the commonest cause of infirmary admission among students at the University of Philippines -64.2%[49]. In 27.9% of cases with ARI tested, virus was isolated.

A representative investigation of ARI was carried out in Panama Canal Zone during a 4 year period[50]. The age-specific prevalence of antibodies against a number of respiratory viruses was examined. Generally the curves of prevalence were similar to those observed with the appropriate antigens in Germany[51], United-States[29,52,53], Bulgaria[32] and USSR[54].

During the same investigation carried out in Panama Canal Zone, serologic evidence of viral etiology was demonstrated for RSV in 14.7%, PI virus type 1 -8%, PI virus type 2 -0.7%, PI virus type 3 -8%, adenoviruses -4%. These results are comparable to that observed in Bulgaria in 1984[55] where antibody responses to RSV were also detected more frequently (10.3%) than to adenoviruses - 6.3%, PI virus type 1 - 3.3%, PI virus type 2 - 1.9% and PI virus type 3 - 2.9%. An increasing number of studies from tropical countries show the similarity in the incidence and the pattern of viral respiratory diseases between countries with temperate climates and those with warm climates[45].

Viral ARI in childhood

The respiratory viruses were said to have an important role particularly in childhood pathology[19,56,57]. However most of the information originates from studies carried out in countries with temperate climates. In many tropical countries little is known on the subject. Nevertheless the last twenty years has provided some data. In a study organised by WHO[58], paired sera from 528 children up to 5 years old admitted to hospital with severe respiratory illness were collected in 10 tropical countries and were tested by complement fixation test. In most of the countries the pattern of infection was similar. RSV was the most important respiratory tract pathogen of early life (19%), particularly in the first year of life and in cases of bronchiolitis and pneumonia. The PI viruses were next in importance (16%) particularly in cases of croup, but they were commoner in older children (1-2 years). Adenoviruses (6%), influenza A virus (4%) and influenza B virus (2%) were of moderate importance. This pattern is similar to that which has been observed in temperate climates[19,56,57].

A 2-year study was undertaken to establish the incidence and possible viral etiology of ARI among the child population in Rio de Janeiro, Brazil[59]. Viruses were isolated from 20.4% of the throat swabs collected. Of the viruses identified, 47% were adenoviruses, 9% were influenza A virus, 7% - PI viruses, 3% - RSV, and 1% - influenza B virus.

A prospective study of acute LRTI in children under 15 years old was undertaken in Cali, Colombia[60]. A viral agent was identified in 29% of the patients with croup, 20% with tracheobronchitis, 22% with bronchiolitis and 17% with pneumonia. RSV was found in 9% of the cases being the commonest viral pathogen in young infants with bronchiolitis and pneumonia. The other 3 viruses, with which RSV accounted for 94% of all virus identification, were adenoviruses, PI viruses types 1, 2, and 3 and influenza A virus.

Similar results were obtained during an investigation of patients with ARI in Trinidad[61]. 94 cases were found to have RSV infection. Eighty-four per cent of them were less than three years of age.

In a study from Uganda[62] the important role of viruses in the etiology of ARI in infants and young children were confirmed. More than one-third of the cases of respiratory tract infection were of viral origin. The most important of the viruses were RSV (17%) and PI viruses (9%). Adenoviruses were found to be less important and were etiologically related to only 4% of respiratory disease cases.

A study carried out in Kuala Lumpur,

Malaysia[63] showed that in 28.9% of the cases with ARI, viruses were isolated. The most common viruses isolated were RSV and rhinoviruses. Other viruses isolated were PI and influenza A viruses. Mycoplasma Pneumoniae and respiratory viruses are common precipitants of wheezing episodes in asthmatic children in Singapore[64], where PI virus infection was accounting for 9.9% of admissions, followed by the RSV - 9.1%. Influenza A virus and rhinoviruses were found in 3.3% of admissions each and adenoviruses in 2.5% or viruses were accounting for 28.1% of admissions. Mycoplasma Pneumoniae infection was associated with 16.5% of admissions. In only 5% of children wheezing episodes were related to bacterial infection.

The data among Nigerian children, although scanty, also confirm the role of respiratory viruses. Ogunbi[65] reported a serological study of 103 children with LRTI seen at the Lagos University Teaching Hospital. In 53 cases of bronchiolitis 11.3% were positive for RSV. Adenoviruses, PI viruses and influenza viruses were found in 5.6% of cases each. Also in Lagos Njoku-Obi and Ogunbi[66] observed that 32% of children aged between 1-5 years had RSV complement fixing antibodies.

Several investigations, concerning etiological role of RSV have been made among hospitalised children in Benin City. Dym, Schuit, Nwankwo and Omene[67] examined 80 nasopharyngeal secretions obtained from patients between 6 weeks and 3 years of age admitted with pneumonia or bronchiolitis. Fifty-four per cent of them had a positive ELISA for RSV. Okuonghae[68] studied the nasocomial spread of RSV infection in a newborn nursery in Benin during a 12 week period. A total of 56 babies were studied. 11 babies (20%) acquired the infection nasocomially. The infected babies were all symptomatic and some had significant morbidity.

The results of these studies corroborate the findings of studies carried out in temperate areas of the world that have identified RSV, PI viruses, adenoviruses and influenza viruses as the most frequent viral agents associated with respiratory tract infections in childhood.

Seasonal variations

In temperate climates RSV and influenza viruses cause yearly outbreaks of infection usually during the winter months, whereas PI virus types 1 and 2 characteristically produce epidemics in the fall of every other year. Infections with rhinoviruses, coronaviruses, reoviruses, adenoviruses and PI virus type 3 are endemic, occurring in all seasons of the year. The variation from season to season in the incidence of respiratory disease in the temperate zone suggests that the frequency and distribution of such infections might be different in regions with warm climates year-round. This idea has, from time to time, stimulated investigations into the role of respiratory pathogens in the tropics, but much of the work has been limited to the demonstration of the presence of a single agent[42,45,47,69,70].

According to a study from Rio de Janeiro[59], influenza A viruses were circulating in the late autumn and winter (dry season). Influenza outbreaks in Pune, India are reported to occur in the hot season (March) and rainy season (July-September) [38,43]. But data from Nigeria[70] show that the influenza outbreak in 1974 coincided with the onset of the harmattan season (November). Whereas in a study of paired sera collected in several tropical countries[58] and in a study from Uganda[62] no marked seasonal distribution of influenza virus infections was observed.

PI viruses and adenoviruses were observed to be causing infections at all times of the year [9,58,60,61,62]. Inspite of relatively more observations concerning RSV infection the seasonal pattern of RSV activity in a tropical climate remains unclear. Studies in Trinidad[61], Phillipines[49], Singapour[71] have reported that RSV activity occurs in sharply defined outbreaks during the rainy season of the year. Other projects have failed to demonstrate this pattern consistently[6,59,60,62,72].

Conclusion

Despite the great attention given to investigations of viral respiratory infections in recent years, the available information on their etiology in tropical areas remains incomplete. There are no information about the etiological role of coronaviruses and reoviruses in ARI. The data concerning seasonal prevalence of viral ARI are incomplete and contradictory. In many studies the number of patients investigated were insufficient to allow reliable conclusions to be drawn. Nevertheless the data presented in this review have draw attention to the seriousness of viral respiratory infections in tropical countries. This information indicates the need for long-term observations in differing epidemiological

settings to provide a rational basis for prophylaxis, diagnosis and therapy of viral ARI.

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(Accepted 15 June, 1992)