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Original Research Article

A cross-sectional study to assess the epidemiologic profile and complications among chickenpox patients in an infectious disease hospital in a Metropolitan city

Prahatheeswaran G.[1], Abhinand Sai M. B.[2]*, Pavan Laxman Sable[1]

[1]Department of Community Medicine, Seth G. S. Medical College and KEM Hospital Mumbai, Maharashtra, India
[2]Department of Community Medicine, Government Medical College Alibag, Raigad, Maharashtra, India

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***Correspondence:**
Dr. Abhinand Sai M. B.,
E-mail: abhinandsai@gmail.com

ABSTRACT

Background: Chickenpox is a highly contagious and acute disease caused by the varicella-zoster virus. According to a WHO position paper, varicella has a global disease burden of 140 million infections, 42 million severe sequelae, and 4200 fatalities every year. Chickenpox affects 16 persons per 1,000 people annually in wealthy countries. With a case fatality rate of 3 per 1,000 instances annually, 3% of these cases have problems, and 5% require hospitalization. This cross-sectional study assesses the epidemiological determinants & complications among the patients admitted to infectious disease hospitals.
Methods: It was a descriptive, cross sectional and hospital based study. Total duration of study was 18 months (Jan 2020 -August 2021), conducted in infectious hospital of a metropolitan city. A total of 453 patients with confirmed diagnosis of chickenpox and getting admitted in the infectious disease hospital .were selected as study subjects and interviewed by a validated questionnaire.
Results: A total of 453 chickenpox patients were included in the study and because of covid pandemic situation only 118 samples are interviewed of which 91 (77.1%) were males, remaining 27 (22.9%) were females and all 118 (100%) patients presented with rash which is the diagnostic feature of chickenpox, out of that 106 had fever, 84 had cough, 74 had malaise and 32, 17 patients had shivering and backache respectively.
Conclusions: It was found that about one-quarter of cases recorded were in the age group of 19–40 years. This group most probably comprised those who missed the vaccination when they were children. Health education among the general population is suggested to reduce the secondary cases by early diagnosis and vaccination and isolation to reduce the burden of diseases.

Keywords: Chickenpox, Epidemiology, Infectious disease

INTRODUCTION

Chickenpox is a highly contagious and acute disease caused by the varicella-zoster virus. According to a WHO position paper, varicella has a global disease burden of 140 million infections, 42 million severe sequelae, and 4200 fatalities every year. Chickenpox affects 16 persons per 1,000 people annually in wealthy countries. With a case fatality rate of 3 per 1,000 instances annually, 3% of these cases have problems, and 5% require hospitalization. Children, who account for more than 90% of cases, 70% of hospital admissions, and 50% of mortality, have the highest disease burden.[1] In India, chickenpox is seen in both endemic and epidemic forms.

Chickenpox cases can be discovered at any time of year. Their numbers, however, are higher from winter to summer, particularly following the rainy season. It is very contagious, with a secondary infection incidence of over 90%.

The varicella-zoster virus (VZV) causes chickenpox, a highly contagious disease characterized by a widespread rash. Infection is spread mainly by direct contact with the infectious virus in skin sores or through respiratory secretions spread through the air.[2]

The epidemiology of varicella varies depending on whether you live in a temperate or tropical area. In most temperate regions, more than 90% of persons get infected before adolescence. In contrast, the disease is acquired later in many tropical climes, and adults are more susceptible than children. Changes in population density and risk of exposure, differences in transmissibility of the heat-labile varicella-zoster virus under hot, humid circumstances, environmental and societal factors, or a combination of all of these factors could explain epidemiological variance. Fever, malaise, and the characteristic itchy rash are the first symptoms of clinical varicella, typically developing after a 10-21 day incubation period. Varicella usually is self-limiting, and vesicles build crusts over 7-10 days before disappearing. Until all sores have crusted over, individuals remain contagious.[3]

Varicella commonly causes systemic signs and symptoms, including fever, headache, malaise, shivering, cough and cold. Patients with chickenpox are considered infectious for 1 to 2 days before the rash appears and another 4-5 days afterwards.[4,5] The foetus and newborns are at risk of infection occurring during pregnancy. In 2% of cases, congenital varicella syndrome develops when the mother develops varicella during the first 20 weeks of pregnancy. The newborn has a high chance of serious illness if a pregnant woman gets the condition within five days of delivery.[6]

Furthermore delaying the onset of chickenpox from childhood to age might be fatal when it is mild. This could result in more frequent or severe herpes zoster in later years than natural conditions. Immunocompromised adolescents, pregnant women, and newborns exposed to maternal varicella should get passive immunization as a post-prophylaxis.[7,8]

Passive immunization as prophylaxis in previously immunized children may result from close contact between a vulnerable high-risk patient and a patient with herpes zoster. Breakthrough varicella occurs when a child develops a rash 42 days after receiving the chickenpox vaccine and is caused by the mild varicella-zoster virus. Because this strain of varicella is contagious, it should be isolated.[9,10]

Invasive conditions can be life-threatening, most of them are pneumonia, arthritis, osteomyelitis, necrotizing fasciitis, sepsis. Complications of the central nervous sysytem are cerebellar ataxia, meningoencephalitis, meningitis, vasculitis affecting small or large vessels.[11,12]

A similar epidemiological study done in Maharashtra state shows vesicular rash with fever was a common clinical presentation with 82% cases having contact history with VZV positive cases, suggesting higher secondary attack rate.[13]

A study assessing the rising trends of chicken pox outbreaks among school children in Kashmir showed a hundred percent of outbreaks occurred in rural areas and there were no difference in occurrence among genders. A seasonal pattern was observed, with cases increasing during warm months. The average age of patients was 10 (4-20) years; notably, all the infected children were not immunised. Similar studies are lacking in the current study setup.[14,15]

Aim of study was to assess the epidemiological determinants among the patients admitted in infectious disease hospital. Also, to identify epidemiological determinants associated in chickenpox cases, to study the clinical features and complications of chickenpox cases, to study the association of sociodemographic factors with chickenpox complication among study subjects, and to predict the trend of chickenpox cases admitted based on 10 years retrospective data.

METHODS

Study area

A hospital based descriptive prospective cross-sectional study conducted in infectious disease hospital in metropolitan city.

Inclusion criteria

All patients with confirmed diagnosis of chickenpox and getting admitted in the infectious disease hospital. No exclusion criteria.

Study duration and period

Study period was 18 months from Jan 2020 to August 2021.

Procedure for obtaining informed consent

Informed consent document was prepared by investigators as per guidelines of Institutional Ethics Committee. This consent was in three languages i.e. English, Hindi and Marathi. This was explained to participant in language which he/she understood.

Discontinuation and with-drawl criteria

If participant was uncomfortable during interview due to any reason he/she had right to discontinue interview from study.

Sampling method

Convenient sampling method will be used. Convenience as per 1st come basis with weighted representation. As per last year record proportion of cases per calendar month will be calculated. 453 sample will be divided over 12 months in the same proportion and cases will be enrolled by 1st come basis.

Study procedure

Study procedure was divided in three phases:

Preparatory phase

Approval for conduction of study was taken from Institutional Ethics Committee. A semi structured interview schedule was prepared along with protocol according to objectives of this study. This interview schedule was validated from senior faculty and experts in the field (including members of Department Review Board). Necessary modifications were made as suggested by these experts.

Data collection

Before starting data collection infectious disease hospital was visited by Investigator along with the Community Development Officer for getting better idea of the study area and building good rapport with the study population.

Then study area was visited by investigator to collect data one by one. Data was collected from the adults chickenpox patients in ward as mentioned above satisfying the inclusion and exclusion criteria. Informal discussions were done with the study participants in order to build rapport before data collection. The purpose of the study was explained to the study participants. Then informed consent was taken from study participants. Confidentiality of the study was maintained. The study participants were assured that the details and information provided by him/her will not be disclosed to anyone. The data collection was done through interviewing the subjects at the time of discharge from hospital. All the responses given by the participants were recorded with help of an interview schedule.

Procedure of interview

After obtaining informed consent, study participants were interviewed by the investigator in their own vernacular language. The subjects were assessed about their age group, educational status, occupation, socioeconomic status, history of presenting illness and past history of patients, complications of chickenpox.

Sample size

$$n \leq \frac{Z^2pqN}{e^2(N-1)+Z^2pq}$$

where, Z = 1.96 (95% CI or 5% level of significance); n = sample size; e = + 5 absolute precision; p = proportion of complication (32.3); q = 100-p (67.7); Design effect = 1.5; Sample size = 453.

Statistical analysis of data

Data entry was done using Microsoft Excel 2013 version. Data collected was tabulated and graphically presented wherever required. Data was analysed using SPSS software version 22.0 and statistical tools like mean, range, proportion and test of significance was used whenever required. A p value of less than of 0.05 was considered as significant.

RESULTS

The study was a cross-sectional descriptive study to assess the epidemiological determinants among the patients admitted to infectious disease hospital.

In my study period (April 2020 to October 2021), the total number of chickenpox patients admitted to infectious disease hospital was 149.Out of 149, children were 31 (21%) and adults were 118 (79%). The child to Adult ratio is 1:4.

The average number of adult chickenpox patients admitted annually at infectious disease hospital in a metropolitan city was 2000. Still, COVID pandemic situation, only 118 cases were accepted from the year April 2020 to October 2021. So, author did not achieve my desirable sample size (n=453).

A total of 118 patients were interviewed. That data was entered in Microsoft Excel and analysed in SPSS version 27 software. The following are the study observations.

Table 1 shows out of a total 118 study subjects, 24 (20.3%) of them were diagnosed with chronic diseases in which DM 11 (9.3%) and HTN 8 (6.6%) were more than bronchial asthma 4 (3.4), allergic rhinitis 1 (0.8) and the remaining 94 (79.7%) were absence of chronic diseases (Table 2).

From Table 3, out of a total 118 study subjects 66 (56%) of them were not alcoholic/smoker, 27 (23%) known alcoholic and 21 (18%) known smoker and alcoholic, the remaining 3 (4%) of the patients were smoker.

Table 1: Sociodemographic profile and clinical features of study participants (n=118).

Age in years	Frequency (n)	Percentage (%)
19-30	68	57.5
31-40	40	33.9
41-50	8	6.8
51-60	2	1.8
Total	118	100.0
Sex		
Male	91	77.1
Female	27	22.9
Marital status		
Married	80	67.8
Unmarried	38	32.2
Socioeconomic status		
Upper class	12	10.2
Upper middle class	41	34.7
Lower middle class	55	46.6
Upper lower class	10	8.5
Occupation		
Labourer	41	34.7
Student	29	24.6
Housewife	21	17.8
Driver	11	9.3
Others	16	13.6
Clinical features		
Without fever	12	10.2
With fever	106	89.8
Without cough/cold	34	28.8
With cough/cold	84	71.2
Symptoms with rash		
Fever	106	12
Cough	84	34
Malaise	74	44
Shivering	32	86
Backache	17	101

Table 4 shows out of a total 118 study subjects 24 (20.3%) of them had a travel history in last one month before getting chickenpox infection, the remaining 94 (79.7%) of the patients had no travel history.

Table 2: Distribution of study participants according to different type of chronic diseases (n=118).

Chronic diseases	Frequency	Percent (%)
No complications	94	79.7
Diabetes	11	9.3
hypertension	8	6.8
Bronchial asthma	4	3.4
Allergic rhinitis	1	0.8
Total	118	100.0

From Figure 1, out of a total 118 study subjects 67/118 (57%) of them had rash in mucosal region, 65/118 (55%) had rash in axillary region and the remaining 27 (23%) of the patients had presented with palm and sole involvement .

Table 3: Distribution of study participants according to different types of substance use (n=118).

Substance use	Frequency	Percent (%)
Alcohol	27	23.0
Tobacco	4	3.0
Alcohol and tobacco	21	18.0
Absence of substance abuse	66	56.0
Total	118	100.0

Table 4: Distribution of study participants according to substance use and haematological abnormalities (n=118).

Substance use	Frequency	Percent (%)
Alcohol		
No	70	59.3
Yes	48	40.7
Tobacco		
No	93	78.8
Yes	25	21.2
Travel history		
No	94	79.7
Yes	24	20.3
Different sites of rash		
Mucosal region	106	12
Axillary region	84	34
Palm and sole region	74	44
Haematological abnormalities		
Thrombocytopenia	18	15.25
Anemia	15	12.72
Anemia with thrombocytopenia	10	8.47

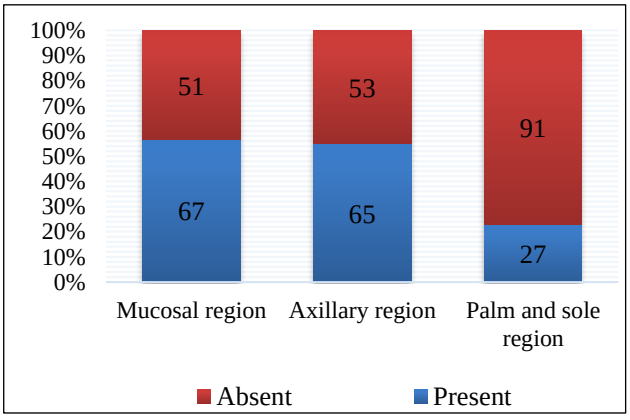

Figure 1: Sites of rash among study subjects (n=118).

Table 5 shows out of a total 118 study subjects 18 (15%) of them were found to have thrombocytopenia, anaemia

15 (13%) and anaemia with thrombocytopenia 10 (8%) and 75 (64%) were absence of chronic diseases.

Total 118 study subjects discharged after complete recovery of symptoms and rash. None of them had developed complication.

Table 5: Distribution of study participants according to haematological abnormalities (n=118).

Hematological Abnormalities	Frequency	Percent (%)
Thrombocytopenia	18	15.25
Anemia	15	12.72
Anemia with Thrombocytopenia	10	8.47
Absent	75	63.56
Total	118	100

DISCUSSION

Table 1 shows the age wise distribution in the study. Out of 118 participants majority 68 (57%) participants were 19-30 years and 40 (34%) participants were 31-40 years. Similar study conducted by Inbaraj et al among chickenpox patients at tertiary care hospital in Bangalore also showed out of 430 study subjects majority of the participants were in 21-25 years age group (47.5%).[20] Similar findings were also found in study conducted by Lokeshwar et al among chickenpox patients in 4 major cities of India: Calcutta, Mumbai, Lucknow, Bangalore where majority of participants were in 21-30 years age group (88.1%).[17]

Similar study was conducted by Meyers et al among varicella cases at a private university in Chennai also showed out of 110 varicella cases, 87 (79%) of them were male while 23 (21%) were female.[16]

The findings was similar to the study conducted by Sahay et al among chickenpox patients in an infectious disease hospital in Mumbai where out of 50 cases majority of participants (79%)belonged to Mumbai and remaining were migrants from West Bengal and Orissa respectively.[20]

Study conducted by Pall et al among chickenpox patients in Jharkhand with a sample of 79 cases showed that majority of the participants belonged to the Hindu (96%) religion.[19]

Study conducted by Sahay et al among chickenpox patients in an infectious disease hospital in Mumbai where out of 50 cases majority cases (90%) were working as Jari workers and labour in a gold shop.[20]

Out of 118 study subjects, 106 (90%) had fever, 84 (71.2%) had cough, 74 (63%) had malaise, 32 (27%) had experienced shivering and 17 (14%) had experienced backache at the time of hospital admission respectively.

Out of 118 study subjects, 85 (72%)of them length of stay was 5 to 10 days, the remaining 33 (28%) patients length of stay in hospital was 11 to 15 days. Similar study conducted by Baltic et al among chickenpox cases in an infectious hospital in Bosnia showed that out of 333 cases, 197 (59%) patients length of stay was >10 days and 136 (41%) patients length of stay was <10 days.[26] 24 (20.3%) patients were diagnosed with chronic diseases, remaining 94 (79.7%) were absence of chronic diseases.[20]

Out of 118 study subjects, 24 (20.3%) of them were diagnosed with chronic diseases in which diabetes 11 (9.3%) and hypertension 8 (6.6%) were more than bronchial asthma 4 (3.4), allergic rhinitis 1 (0.8) and the remaining 94 (79.7%) were absence of chronic diseases. The findings was similar to study conducted by Sahay et al among chickenpox patients in an infectious disease hospital in Mumbai showed that out of 50 cases, one patient had a history of type 2 diabetes mellitus and tuberculosis. No other immunocompromised conditions were noted.[22]

Table 6: Association of age, gender and socioeconomic status of the patient with length of the hospital stay among study subjects.

Age group (years)	Length of hospital stay (%)		Total (%)	P value
	<10 days	>10 days		
19 to 40	51 (75)	17 (25)	68 (100)	0.40
41 to 60	34 (68)	16 (32)	50 (100)	
Gender of patient				
Male	64 (70.3)	27 (29.7)	91 (100)	0.44
Female	21 (77.8)	6 (22.2)	27 (100)	
Socioeconomic scale				
Upper class	6 (50.0)	6 (50.0)	12 (100)	0.29
Upper middle class	29 (70.7)	12 (29.3)	41 (100)	
Lower middle class	42 (76.4)	13 (23.6)	55 (100)	
Upper lower class	8 (80.0)	2 (20.0)	10 (100)	
History of fever				
Yes	77 (72.6)	29 (27.4)	106 (100)	0.28
No	8 (77.8)	4 (22.2)	12 (100)	

Table 6 shows that out of 118 study subjects, 48 (40.7%) of them were known alcoholic, the remaining 70 (59.3%) of the patients were not alcoholic. 25 (21.2%) of them known smoker, the remaining 93 (78.8%) of the patients were non-smoker respectively. Similar study conducted by Sahay et al among chickenpox patients in an infectious

disease hospital in Mumbai showed that out of 50 cases, history of tobacco 22 (44%), alcoholism 5 (10%) and smoking 1 (2%) were elicited from patients.[22]

Table 6 shows that out of 118 study subjects, in which age group 19 to 40 years 51 (75%) patients length of hospital stay was <10 days, 17 (25%) patients length of stay hospital stay was >10 days and 41 to 60 years 34 (68%) patients length of hospital stay was <10 days, 16 (32%) patients length of stay hospital stay was >10 days respectively. Pearson chi-square statistics x2=0.701 and p=0.402. Hence, there is no statistically significant association between age of patients and length of hospital stay. Similar study conducted by Baltic et al among chickenpox patients in an infectious disease hospital in Bosnia showed that out of 333 cases, adult patients (mean = 12 days) length of stay in hospital was longer than children (10 days). Chickenpox is a potentially severe illness in adult patients.[18]

CONCLUSION

The cross sectional descriptive study was conducted to assess trend of chickenpox cases among adult patients admitted in infectious disease hospital in a metropolitan city. A total of 118 participants were interviewed with a semi structured validated questionnaire. The data analysis was done in SPSS software version 27. Based on the responses given by the study subjects, epidemiological determinants, clinical features, complications of chickenpox and time series analysis of chicken pox cases were studied and expressed in proportions and tabulated in the results section. This study provides detail information about the chickenpox-cases among adult patients admitted in infectious disease hospital in a metropolitan city. Out of 118 study subject, majority of patients 68 (57.5%) were in 19-30 years of age group and gender distribution 91 (77.1%) were males, remaining 27 (22.9%) were females. In the present study, all 118 (100%) patients presented with rash which is the diagnostic feature of chickenpox, out of that fever 106 had fever, 84 had cough, malaise 74 had malaise and 32, 17 patients had shivering and backache respectively.

Recommendations

Based on findings of the study.

Chickenpox is a contagious infectious disease that can produce a localised outbreak. Although it has a low mortality rate, it has high prevalence and morbidity rate in the community. It may lead to complications like pneumonia, secondary bacterial infection, encephalitis, Reyes syndrome, hemorrhagic complications.

Early Identification of cases, diagnosis, isolation and clinical management apart from vaccination is the key strategy to control chickenpox and prevent local outbreaks.

Regular training programmes: Regional Training Programme on Prevention and Control of Communicable Diseases for health workers. So that highly contagious communicable diseases can be picked in time and such outbreaks can be prevented.

Vaccination against chickenpox is not recommended in the Indian Universal Immunisation Programme. However, the Indian Academy of Paediatrics suggests that it can be given to Adolescents who have not had varicella in childhood, household contacts of immuno-compromised children, children attended crèches and day care centres and susceptible adolescents and adults if they are working in the institution set up (e.g. school teachers, day care centre workers, military personnel, health care professionals, etc.

Varicella vaccination when used as post exposure prophylaxis in children within 5 days of exposure significantly reduces the chance of developing clinical varicella infection. The effect is more pronounced if vaccine is given within 3 days of exposure, and prevents nearly all cases of moderate to severe varicella.[21]

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