



Original Research Article

OUTBREAK INVESTIGATION OF VARICELLA-ZOSTER AMONG HOSTEL INMATES AT TERTIARY CARE CENTRE, KALABURAGI, KARNATAKA: A CASE-CONTROL STUDY

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ABSTRACT

Background: Varicella (chickenpox) is a febrile rash illness resulting from a primary infection with the varicella-zoster virus (VZV). The disease is more prevalent in children than adults. Adults when affected manifest severe symptoms.

Material and Methods: Following a sudden increase in cases in April 2023, an outbreak investigation and a matched case-control study were conducted, to assess the risk of varicella transmission among hostel inmates of a tertiary care center in Kalaburagi. Based on the clinical diagnosis, 8 cases and 32 controls matched for gender and year of course were chosen. The survey was conducted using an epidemiological case sheet, containing students' sociodemographic profile and clinical history, after obtaining written consent. Data was entered in an Excel sheet and analysed using JAMOWI software. The outbreak was described in terms of time, place, and person using descriptive statistics. The odds ratio was calculated to assess the strength of the association between risk factors and varicella infection.

Results: The index case, 22 years old was detected on 7th April, 2023 in boys hostel following which 7 more students were affected with a secondary attack rate of 6.93%. Mean (SD) age of cases was 20.13(1.36) years and males (75%) were most commonly affected. Majority (62.5%) presented with moderate lesions with none developing complications. All cases were identified and isolated (mean duration of 12.75(3.93) days) with strict precautions. Personal protective measures usage was significantly protective against varicella among risk factors, with an odds ratio of 0.09 (95% CI 0.01, 0.51).

Conclusion: With the help of active case finding, isolation, and vaccination campaigns, the outbreak was successfully controlled.

Keywords: Varicella Zoster, Outbreak, Hostel, Case-Control study.

INTRODUCTION

The varicella-zoster virus (VZV), which causes chickenpox, is a highly contagious viral infection. It mostly affects children, though it may affect anyone at any age who is not exposed to virus before or not received a vaccination. Despite the availability of vaccines, it continues to be a significant global health concern due to its potential for complications,

especially in vulnerable populations such as adults, pregnant women, and immunocompromised individuals. Even though zoster can manifest at any stage of life, its prevalence rises as age increases as a result of attenuated immunity. It is estimated to affect around 50% of individuals until they reach the age of 85.^[1,2] Adults are more likely to develop complications, unlike children. An outbreak is

characterized as the presence of more than 5 varicella cases that are related to place and are epidemiologically linked.^[3] Though various factors influence the emergence of outbreaks like age, immunity, and environmental factors, climate also plays a role. The epidemiology of varicella differs in tropical climates, where individuals tend to acquire the disease at later ages. As a result, a larger proportion of adults in tropical climates are susceptible to varicella compared to people in temperate climates.^[4] Kalaburagi, an underdeveloped district in the tropical region is more prone to outbreaks of chickenpox infection. The rationale for investigating an epidemic is that ongoing exposure to the origin of infection may be reduced by discovering and eradicating the source of infection resulting in reduction of more cases.^[5] The transmission of the virus among healthcare staff and susceptible patients can spread through respiratory route and, less commonly, by close contact with the blister fluid making patients vulnerable to infection.^[6] Given that the secondary attack incidence is approximately 80% in households, it is expected to rise to 90% in healthcare facilities.^[7] Institutional environments, such as hostels, classrooms, and shared housing, are often associated with outbreaks.

In April 2023, an outbreak of varicella infection emerged among the undergraduate residents of the girls and boys hostel at a tertiary care centre, Kalaburagi. An outbreak investigation with ways of control measures and a matched case-control study were undertaken to assess the risk factors associated with varicella infection among the hostel inmates.

MATERIAL AND METHODS

Following a sudden increase in cases with fever and rash among medical undergraduates, with directions from the medical superintendent, an outbreak was confirmed followed by an investigation conducted by the Department of Community Medicine, Gulbarga Institute of Medical Sciences (GIMS), Karnataka consisting of faculties and postgraduate students in boys and girls hostel among hostel inmates on 29th April 2023. The index case was isolated following which the other cases were identified with the help of the clinical case definition given by the Centres for Disease Control (CDC) by active surveillance.

2.1 Case definition:

A resident of the hostel with acute onset of itchy, diffuse (generalized) macular-papular-vesicular rash without other apparent cause progressing from fluid-filled vesicles to dried crusts and scabs.

Probable: A case that meets the clinical case definition but is not laboratory-confirmed nor epidemiologically linked to another probable or confirmed case.

Confirmed: A case that meets the clinical case definition and is laboratory-confirmed or is

epidemiologically linked to a confirmed or probable case.

Two probable cases that are epidemiologically linked are considered confirmed, even in the absence of laboratory confirmation.^{1,2}

Population at risk: Residents of the hostel or close contacts of the primary case.

2.2 Data collection: By following necessary precautionary methods, active surveillance was conducted by interviewing the cases face to face who were isolated in separate floors provided in the hostel. After obtaining informed verbal consent, data was collected from the cases using an epidemiological case sheet consisting of details regarding their socio-demographic profile and clinical history which was prepared according to CDC guidelines.² A proxy indicator was used to assess the number of lesions.

- Less than 50 lesions (Mild) – The lesions are easy to count in 30 seconds.
- 50-249 lesions (Moderate) – A person can place their hand over lesions without touching them.
- 250-499 lesions (Severe) – Hands cannot be placed over lesions without touching them.
- More than 500 lesions (Very severe) The lesions are so close together that normal skin is hard to see.²

Following the outbreak investigation, a 1:4 matched case-control study was conducted to assess the risk factors associated with varicella infection among 8 infected cases and 32 controls. Controls were the population at risk without clinical manifestations who were randomly chosen and matched for gender and year of the course.

Collected data were entered into an Excel sheet and analysed using JAMOVI software. Outbreak investigation was described in terms of time, place, and person. The odds ratio was calculated to assess the strength of the association between risk factors and varicella infection.



Figure 1: depicts the data collection done at outbreak site

RESULTS

Outbreak investigation

A total of 8 cases were found to be infected with VZ and were clinically diagnosed (6 Boys & 2 girls of 1st year MBBS and 2nd year MBBS). The index case, a 22-year-old male residing at boys hostel was detected on 7th April 2023, presented with sudden onset of severe headache and fever, followed by mild rashes on consecutive days. Soon after the appearance of mild rash, there was a history of travel with 13 of his friends of which 5 of them developed symptoms. He had a history of visit to a blood camp and local supermarket days before the onset of symptoms with no past history of chickenpox or any past illness. Approximately, < 50 rashes were observed with the nature of the rash being vesicular, centripetal in distribution predominantly found on the trunk and face, associated with itching and sleep disturbances, typically suggesting a varicella-zoster infection. Following this, with a mean incubation period of 15.85(2.57) days, 2 more cases were reported with similar complaints, who had a previous history of contact with the other case and residing at the same hostel premises with a secondary attack rate of 6.93%. Fig 2 shows the epidemic curve indicating a point source epidemic.

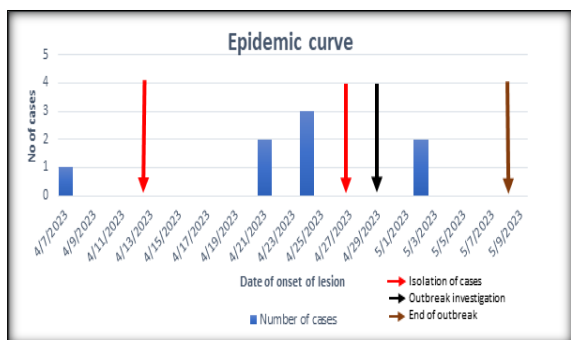


Figure 2: Epidemic curve

Table 1 shows the clinical picture of cases. The mean (SD) age of cases was 20.13(1.36) years. Males were most commonly affected (75%). The majority (62.5%) had moderate lesions with none developing complications. Lesions persisted for a mean duration of 23.25 days with a majority (75%) having typical vesicles/blister lesions. [Table 1] Figure 3 shows the location of lesions revealing 100% lesions in trunk followed by face and limbs with a minority involving mucosa showing a

centripetal characteristic. All cases were isolated with strict precautions with a mean duration of 12.75 (3.93) days.

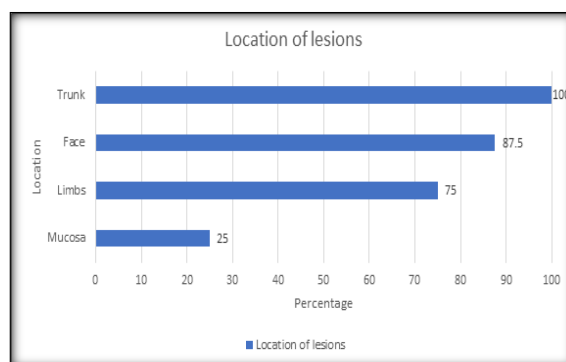


Figure 3: Location of lesions among the cases

The cases were started on antiviral and symptomatic treatment accordingly. The search for other cases was done by enquiring about their batchmates, roommates, and hostel staff. The suspects and contacts were identified and were advised to follow strict aseptic precautions. Disinfection of rooms was done by following standard guidelines. The outbreak report was submitted to the Administration. Hostel wardens were given instructions on how to control the outbreak through the College Administration. A vaccination campaign was held to vaccinate the unvaccinated. With the help of strict surveillance and precautionary measures, the outbreak was controlled within a very short period with minimum cases.

3.2 Case-control study

A total of 8 cases and 32 controls were enrolled in the study. Table 2 shows the sociodemographic profile of cases and controls. The mean age of controls was 19.38 (1.45) years.

Table 3 shows the strength of the association of factors with the incidence of disease. The majority (87.5%) of cases had a negative history of chicken pox as compared to those among controls (62.5%), with an odds ratio of 0.24 (95% CI 0.03,2.18), however, this association was statistically non-significant. Those using personal protective measures were found to be more among controls (87.5%) compared to cases (37.5%), with an odds ratio of 0.09 (95% CI 0.01,0.51) and a significant p-value (0.01). Controls (28.1%) were found to be higher among those vaccinated, than those among cases (12.5%) pertaining to an optional vaccine. [Table 3]

Table 1: Sociodemographic & Clinical profile of varicella infections among cases

Sociodemographic profile	Criteria	Frequency N=8, %
Age (in years)	18-20	2(25)
	20-22	6(75)
Gender	Male	6(75)
	Female	2(25)
Course year	First-year	6(75)
	Second year	2(25)
Residence	Boys hostel	6(75)

	Girls hostel	2(25)
Clinical profile	Criteria	Frequency N=8, %
History of travel	Yes	5(67.5)
	No	3(32.5)
Duration of rashes	<10 days	2(25)
	10-20 days	0(0)
	20-30 days	3(37.5)
	30-40 days	3(37.5)
Type of rash	Vesicle/blister	6(75)
	Macule/papule	2(25)
Severity of rash	Mild	3(37.5)
	Moderate	5(62.5)
Duration of fever	1-3 days	4(50)
	3-5 days	3(37.5)
	5-7 days	1(12.5)
Incubation period	10-15days	3(37.5%)
	15-20 days	3(37.5%)
	21-25 days	2(25%)
Isolation duration	<10 days	1(12.5)
	10-15 days	3(37.5)
	15-20 days	4(50)
Treatment taken	Yes	8(100)
	No	0(0)
Developed complications	Yes	0(0)
	No	8(100)
Recovered	Yes	8(100)
	No	0(0)

Table 2: Sociodemographic profile of cases and controls

Sociodemographic profile	Criteria	Case (N = 8, %)	Control (N = 32, %)
Age (in years)	18-20	2(25)	22(68.7)
	20-22	6(75)	6(18.7)
	>22	0(0)	4(12.5)
Gender	Male	6(75)	24(75)
	Female	2(25)	8(25)
Course year	First-year	6(75)	26(81.3)
	Second year	2(25)	6(18.7)
Residence	Boys hostel	6(75)	13(40.6)
	Girls hostel	2(25)	8(25)
	Day scholar	0(0)	11(34.4)

Table 3: Strength of association of risk factors with disease

Risk Factor	Criteria	Cases (n,%) N=8	Control (n,%) N=32	Odds ratio	P value, 95%CI
History of chickenpox	Yes	1(12.5)	12(37.5)	0.24	0.20{0.03,2.18}
	No	7(87.5)	20(62.5)		
Usage of personal protective measures	Yes	3(37.5)	28(87.5)	0.09	0.01{0.01,0.51}
	No	5(62.5)	4(12.5)		
Vaccination status	Yes	1(12.5)	8(28.1)	0.43	0.45{0.05,4.04}
	No	7(87.5)	24(71.9)		

DISCUSSION

This outbreak investigation centered on evaluating the varicella infection and its associated risk factors. Due to the dry and tropical climate of Kalaburagi, where adult outbreaks are widespread, the results of this investigation were comparable to those of a study conducted by Malakar M et al who also reported disease among adults.^[7] The current outbreak occurred in April, which coincided with the typical January–April seasonal peak of varicella cases in southern India.^[8]

The mean age of the participants in our study was 20.13(1.36) years resembling the study of Karki P et al where it was reported to be 22.33(1.72) years old.⁹ According to our study, males and first- and

second-year course students had higher disease prevalence, which is consistent with the study by Meyers J et al,^[8] Deoshatwar AR et al discovered that females are more affected.^[10] This could be attributed to the contacts with index case during the trip. In the current investigation, the average duration of lesions was 23.25 days, which was lengthier than the study conducted by Poudel RC et al (7.23 days), suggesting the occurrence of moderate lesions among participants.^[11] This study did not reveal any complications among cases because of early detection and adequate treatment, even though adults are more likely to experience the severity of disease, as demonstrated by Kole AK et al.^[12]

It was discovered that the mean incubation period of infection was similar to that of varicella infection, suggesting that the illness originated from a single source. The outbreak diagnosis relied on the clinical definition, while most studies were based on laboratory investigations.^[4,13] A lower secondary attack rate of 6.93% was observed in the present study compared to a higher rate(21.43%) as reported by Karki P et al accounting for strict surveillance and isolation of cases.^[9] Vaccination against varicella and using personal protective measures significantly reduce the incidence of disease, as evidenced by an odds ratio <1 in the present study indicating protection among close contacts.^[14,15]

CONCLUSION

Varicella outbreaks are not uncommon in healthcare institutions and young adults as they are more prone to infection. Getting vaccinated and using personal protective measures is essential in preventing the disease. Early detection of cases by strict surveillance, active case finding, and immunization of unvaccinated individuals with minimal resources in hand helped in controlling the present outbreak successfully without any morbidity or mortality in a large population.

The strength of the study was to assess protective factors in the prevention of disease using a case-control study. The limitation was a lack of laboratory confirmation but with the help of experts, cases were clinically diagnosed.

Declarations

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Authors contribution

First author: Data collection, Review of literature, Methodology, Data analysis and interpretation, Writing-original draft and editing. **Corresponding author, Second, Third, Fourth, and Fifth author:** Development of epidemiological case sheet, Conceptualization, supervision, writing-review and editing

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