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Seroprevalence of Marburg virus: A modeling study in endemic area

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ABSTRACT

OBJECTIVE: An old disease called the Marburg virus infection has just recently started to appear in some African nations in recent years. The disease is currently being scrutinized for its potential to become a new global public health issue.

METHODS: The authors of this work employed a mathematical modeling technique to determine the final seroprevalence rate.

RESULTS: The seroprevalence rate can be estimated based on the results of the current investigation. This incidence may indicate that the endemic nation has an asymptomatic Marburg virus infection.

CONCLUSION: This may also point to the significance of a possible asymptomatic Marburg virus sickness, which may be the cause of the disease's broad transmission. In light of the resurfacing Marburg virus disease concern, it is important to recognize this problem.

Keywords: Marbug virus; infection; seroprevalence.

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The Marburg virus infection is an old disease that has only recently emerged in African countries [1]. The pathogenic virus can exist silently in asymptomatic bats, and this is a big public health concern [2]. Due to the rapid expansion of the outbreak area in Africa, the disease is currently under focus for its possibility of becoming a new global public health threat following the paths of COVID-19 and monkeypox [2, 3]. The risk of medical personnel among healthcare workers is accepted, and it is an important topic for practitioners to recognize [4]. In the human case, the issue of the asymptomatic infection still requires further research [5]. There is a report on an infected case, however, who, after coming into contact with a confirmed patient, got unilateral uveitis after being asymptomatic for two months [6].

The Marburg virus infection has just recently started to appear in some African nations [1]. There are few reports on this issue, and most of them are from African endemic areas. An important point is the seroprevalence, reflecting asymptomatic infection among general population. To get the exact accurate rate, it is necessary to consider the effect of occupational exposure and the false positive chance due to other common diseases. In this article, the authors reappraise locally available data on the seroprevalence rate of Marburg virus disease reported from an endemic area of Africa.

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MATERIALS AND METHODS

Study Design

This study is a retrospective study with the aim of reassessing the available data on seroprevalence of Marburg virus in endemic area, Africa. As a retrospective study, there was no involvement with human or animal subjects, and the ethical committee's approval or informed consent is not applicable.

The primary data was used for further clinical mathematical model studies [7, 8]. To derive the primary data, a standard literature search using an international database was performed first. The search keywords were "Marburg", "virus" and "serology". Only reports that present seroprevalence from the African endemic countries (Cameroon, Uganda, and Ghana) were included for further analysis. The exclusion was set for any incomplete or non-English report. The main outcome of this study was the seroprevalence rate.

Clinical Mathematical Model Study

The summative analysis was first done in order to get the overall seroprevalence rate. The effect of occupational exposure was then excluded. Data from any cases with a risk occupation, which is hereby the miner, as well as those who lived in the high-risk exposure region, were excluded. The adjusted rate after exclusion of the occupation exposure group was first derived.

After that, the effect of false positives due to other common infections in the study area was excluded. According to the previous reference, there was a chance of false-positives equal to 0.8% [9]. This specific rate was directly subtracted from the previously adjusted rate after the exclusion of the occupation exposure group.

Statistical Analysis

The descriptive statistical analysis was done. The arithmetical manipulation was done. The summative seroprevalence rate was derived according to this formula, "summative seroprevalence rate = overall number of seropositive cases/overall number of investigated cases". The 95% confidence interval of the derived summative seroprevalence rate was also calculated and presented. The IBM SPSS Statistics program (Chicago, USA) was used for all statistical analysis.

Highlight key points

- An old disease called the Marburg virus infection has just recently started to appear in some African nations in recent years.
- It may indicate that the endemic nation has an asymptomatic Marburg virus infection.
- Asymptomatic Marburg virus sickness may be the cause of the disease's broad transmission.

TABLE 1. Seroprevalence rate for Marburg virus in this study

Steps	SR (%)
Primary data	1.63
Adjustment for exclusion of occupation exposure group	1.86
Correction for false positive chance	1.06

SR: Seroprevalence rate.

RESULTS

Primary Data

According to the primary data search, there are 122 publications. From inclusion/exclusion, there are 2 reports for further analysis [7, 8]. According to the recruitment, there is seroprevalence data on 3,124 overall.

Seroprevalence Rate

From the overall 3,124 cases, there were 51 positive samples. There were 433 cases, with 1 Marburg positive case, who had a high-risk exposure occupation or lived in the high-risk exposure region. Hence, there would be 50 positive cases from 2,691 cases after exclusion of the occupation exposure group. The adjusted rate after exclusion of occupation exposure group is presented in Table 1. The derived rate after exclusion of the occupation exposure group was then subtracted with a possible false-positive chance. The final overall seroprevalence rate was equal to 1.06%. The 95% confidence interval for the overall seroprevalence rate was 0.59% to 1.63%.

DISCUSSION

The filovirus family includes the Marburg virus, which causes a deadly and very debilitating hemorrhagic fever, along with the Ebola virus. The virus's case fatality rate ranges from 24.0 to 88.0%, highlighting both its deadly nature and the requirement for public knowledge about it [1]. Those who were working in a lab with African green monkeys were exposed to the Marburgvirus illness for the first time in 1967, and cases of this disease were simultaneously recorded in Germany and Serbia. After the first incidence, there were numerous further outbreaks in countries all over the world, including Kenya, Uganda, Angola, the Congo, and even the United States [1].

In order to monitor the status of the disease's epidemiology, serological surveillance plays an important role. The specific occupation that has a high risk of exposure to the pathogen is the miner [7]. Additionally, someone who lives in the mine area is also considered at risk. In the mine area, there is a report that the positive serological rate was extremely high compared to generally healthy people in non-mine areas [7]. Additionally, the false-positive serology might also be due to other common endemic diseases, such as HIV. Therefore, to get the exact data on seroprevalence rate, it is necessary to consider the effects of occupational exposure and false positives due to other diseases.

Conclusion

Based on the present study, the seroprevalence rate can be assessed. This rate can imply the existence of asymptomatic Marburg virus infection in the endemic country. This can also imply the importance of possible asymptomatic Marburg virus disease, which might be the origin of widespread spread of the disease. This is an issue to be recognized in the current situation of the remerging Marburg virus disease problem.

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REFERENCES

1. Kortepeter MG, Dierberg K, Shenoy ES, Cieslak TJ; Medical Countermeasures Working Group of the National Ebola Training and Education Center's (NETEC) Special Pathogens Research Network (SPRN). Marburg virus disease: a summary for clinicians. Int J Infect Dis 2020;99:233–42. [CrossRef]
2. Guito JC, Prescott JB, Arnold CE, Amman BR, Schuh AJ, Spengler JR, et al. Asymptomatic infection of marburg virus reservoir bats is explained by a strategy of immunoprotective disease tolerance. Curr Biol 2021;31:257–70. [CrossRef]
3. Sah R, Mohanty A, Reda A, Siddiq A, Mohapatra RK, Dhama K. Marburg virus re-emerged in 2022: recently detected in Ghana, another zoonotic pathogen coming up amid rising cases of Monkeypox and ongoing COVID-19 pandemic- global health concerns and counteracting measures. Vet Q 2022;42:167–71. [CrossRef]
4. Selvaraj SA, Lee KE, Harrell M, Ivanov I, Allegranzi B. Infection rates and risk factors for infection among health workers during ebola and marburg virus outbreaks: a systematic review. J Infect Dis 2018;218:S679–89. [CrossRef]
5. Borchert M, Mulangu S, Swanepoel R, Libande ML, Tshomba A, Kulidri A, et al. Serosurvey on household contacts of Marburg hemorrhagic fever patients. Emerg Infect Dis 2006;12:433–9. [CrossRef]
6. Gear JS, Cassel GA, Gear AJ, Trappler B, Clausen L, Meyers AM, et al. Outbreake of Marburg virus disease in Johannesburg. Br Med J 1975;4:489–93. [CrossRef]
7. Nyakarahuka L, Schafer IJ, Balinandi S, Mulei S, Tumusiime A, Kyondo J, et al. A retrospective cohort investigation of seroprevalence of Marburg virus and ebolaviruses in two different ecological zones in Uganda. BMC Infect Dis 2020;20:461. [CrossRef]
8. Steffen I, Lu K, Hoff NA, Mulembakani P, Okitolonda Wemakoy E, et al. Seroreactivity against Marburg or related filoviruses in West and Central Africa. Emerg Microbes Infect 2020;9:124–8. [CrossRef]
9. Vladyko AS, Zaĭtseva VN, Trofimov NM, Shkolina TV, Scheslenok EP, Boshchenko IuA, et al. False-positive reactions in laboratory diagnosis of Lassa, Marburg, and Ebola viral hemorrhagic fevers and AIDS. [Article in Russian]. Vopr Virusol 1997;42:66–70.