



A Review on Smallpox

Yasir Nawaz¹, Ishart Nazar¹, Hussnain Ahmad², Bilal Saeed¹,

Hafiza Rabia Shafiq¹, Muhammad Kaleem Ullah^{1*}, Muhammad Saleem Khan¹, Khadija Iqbal¹.

1. Department of Zoology, University of Okara, Okara, Pakistan.
2. Department of Botany, University of Agriculture Faisalabad Pakistan.

Corresponding Author: Muhammad Kaleem Ullah, Department of Zoology, University of Okara, Okara Pakistan.

Copy Right: © 2022 Muhammad Kaleem Ullah, This is an open access article distributed under the Creative Commons Attribution License, which permits unrestricted use, distribution, and reproduction in any medium, provided the original work is properly cited.

Received Date: September 27, 2022

Published Date: October 04, 2022

Abstract

Smallpox is an infectious disease. The virus that causes smallpox belongs to the poxvirus family, the genus orthopoxvirus, and the species variola virus. High fever, chills, vomiting, stomach discomfort, headache, backpain, and progressive rashes on the whole body are all symptoms of this infection. This disease shows a mortality rate of 2% or less. This virus spreads from natural disasters and some climatic conditions. It is host-specific to man and evenly distresses humans of all ages. This disease is considered the first infectious disease which was eradicated successfully from all over the world. In 1980, WHO declared the eradication of smallpox from the world. Variola was taken as a biological weapon in world-famous wars as well. The mode of transmission for smallpox is direct contact with lesions or through airborne respiratory droplet secretions. Vaccinations eradicate this disease.

Introduction

Smallpox, a dire infectious disease with a transience rate of 30%-50%, originated from the Variola virus (genus orthopoxvirus) in the 20th century. The survivors from the unanimous disease may be blind. Variola minor, reminiscent of variola virus, was also examined in the population but with a less severe infection and mortality rate of 2% or less. The devastating infectious epidemic has killed millions of people from Rameses V to Queen Marry in ancient times (Bilal et al., 2021). It has been conjectured that the evolution of the variola virus has occurred with the development of agriculture, livestock, and close settlements of man after 10,000 B.C as the close interaction of animal-man and man-man favored host-to-host sustainability and transmission of infections. The climate conditions and natural disasters caused millions of people to migrate which favored the propagation of the virus. Nile valley has been the origin of many civilizations and had ultimate paleontological proof of smallpox infection. Asian region (China and India) also has been the host and reservoirs of the variola. (Ellner, 1998). Edward Jenner discovered the smallpox vaccine and a worldwide campaign was driven to vaccinate the people by WHO. In 1977, the mare case of smallpox was reported in Somalia. In 1980, WHO declared the eradication of smallpox from the world. Variola was taken as a biological weapon in world-famous wars as well (Bilal et al., 2021). In the modern age, it can be modified as bioterrorism. Smallpox is host-specific to man and evenly distresses humans of all ages. Fluid-filled pustules, primarily on the facial part, proceed to rash on the whole body (Hildreth et al 2009).

Adaptive immune response against the virus leads to the given symptoms. The action of pro-inflammatory cytokines like TNF α , IL-1, and IL-6 as well as T-cells causes the given cardinal signs. Modern improved cytokine therapies are rendered effective. The evolution of the viral genome can cause a serious issue for mankind, as a new genome sample has been described (Theves et al., 2014). This is the first human infectious disease claimed eradicated however has been serious clinical apprehension due to the evolutionary behavior of viruses. This study aims to review and summarize the epidemiology, diagnostic features, treatment, evolutionary trends, and vaccination trends regarding smallpox disease.

Pathology of Smallpox

Smallpox is a highly catching disease that is due to the smallpox virus. Its mortality rate is more than thirty percent. Smallpox is spreading from individual to individual by intake of respiratory drop and in some cases by direct contact. The infection of Smallpox is traceable for initial 7 to 10 days after infection. The vaccinated person has less chance to infect with this disease. The infection rate is higher than eighty-five percent in unvaccinated people. The virus Smallpox is embedded in the oral airway and reproduces in the lymph node. Classical Smallpox has 9-11 days of incubation cycle after that a zone of 2-3 days of high fever, extreme pain in head and trunk of the body. It also leads to extreme pain in the abdominal portion. The symptoms of smallpox are high fever, discomfort in the metabolic system, severe headache, fatigue, and severe pain in the back. All these symptoms are followed by pustules or lesions appearing on the face, skinny legs, and trunk portion of the body. Peoples after recovery of smallpox have scars on the face, arms, legs, and trunk of the body (Shah et al., 2022).

The oral airway pustules immediately ulcerate. After some time the lesions that present on the skin become pustular. Pustules that are present on the face and trunk become denser than the trunk of the body. The 5-10 percent people of classical smallpox have two forms: hemorrhagic and malignant form. The hemorrhagic form is very rare and has a serious effect. It has lethal effects within five or six days. The malignant form is just like hemorrhagic form except for the outer layer of skin becomes peeled off. The variola minor has symptoms just like classical smallpox but it is less severe and has extreme rashes on an infected person. Researchers make a vaccine against smallpox, which can immune a person from this disease, because it is zoonotic disease like rabies, it comes from cow so humans should avoid to consume much meat (Bilal, 2021; Ali et al., 2021).

Smallpox severity is because of the capacity to invade the host immune system. The proteins which are responsible for the pathogenesis of smallpox are found in the terminal area of DNA. Smallpox virus has many ways to enter a person's body but mostly it prefers the respiratory tract. Sometimes it enters through the skin and placenta. Before the appearance of the rash, the lesions appeared on the oral airways. The virus is released in the form of secretions and makes the person infectious. Smallpox is a dangerous disease that affected people since ancient times. There is no proper treatment for smallpox, but a vaccine prevents this disease as vaccine for covid is available (Bilal et al., 2021)

Discussion

Smallpox was an infectious disease for human beings caused by the Variola virus which belongs to the poxvirus family. The fatality rate of this disease was approximately 30 %. This disease affected millions and caused the death of 300 million people worldwide. Symptoms of this disease start from fever which is followed by progressive rashes on the whole body. Development of these rashes starts from the mouth and face. These rashes appear as fluid-filled, firm dimpled bumps which become crusty and then form scabs. When these scabs fall off, they leave pity scares on the skin. This disease is considered the first infectious disease which was eradicated successfully from all over the world. The global eradication certificate was given by World Health Assembly in 1980. People born before 1971 were vaccinated and no patient is reported in the US after 1972. So, no more vaccination is recommended but the US still has enough vaccines as there is a risk of bioterrorism of this virus (Henderson, 2011; Hildreth et al., 2009). Electron microscope study of poxviruses revealed that these viruses are the largest viral pathogens of humans that have brick shape appearance and size of 300-350 nm. These viruses have all necessary proteins in their cytoplasm so they can also replicate themselves (Voigt et al., 2016).

The mode of transmission for smallpox was direct contact with lesions or through airborne respiratory droplet secretions. Sloughing of lesions also causesthe spreading of infectious particles which also cause transmission of this disease. This disease is caused by lesions from the time of onset to the end of the crust. So, isolation precautions were required for smallpox (Milton, 2012).

smallpox shows man's greatest fear and his efforts to control infectious diseases. This disease not only caused the death of millionsof people but it had a combined effect in causing blindness. Variola virus which is the main causing agent also causestoxemia and skin eruption. A milder form of the disease that is caused by variola minor has a low fatality rate which is approximately 1 %. Eradication of this disease was done through vaccination. Even in ancient times inoculation of the variola virus was done

for immunization purposes. Later on, Jenner introduced and demonstrated more safe and efficient vaccination with another virus known as vaccinia virus (Ellner, 1998). 1977 last case of naturally occurring smallpox virus case was reported in Somalia (Eyler, 2003).

Conclusion

The ocular consequences of smallpox are common and severe. Smallpox ocular effects are uncommon, but in a hypothetical scenario including mass vaccination of 100 million people, roughly 1000 to 2000 instances of ocular vaccinia may be expected. Careful patient education and proper preventive medication can help to limit the incidence of ocular vaccinia (Semba, 2003).

Smallpox was a highly infectious, very lethal illness. Variolation was used to manage the condition in the beginning, but it was contentious and risky. Variation was the topic of some of the first clinical investigations to be reported. Edward Jenner was the first to develop vaccination in 1796. After early resistance from the medical community, smallpox vaccination became mandatory in England and Wales in 1853. Smallpox was finally eradicated in 1980 as a result of this. Contemporary immunization and the smallpox vaccine have parallels, especially given the present heavy media scrutiny of modern vaccines (Stewart & Devlin, 2006).

The smallpox virus was wiped from the world because of its unique virological and immunological properties. It remains to be seen if a similar eradication campaign with other bacteria may provide comparable outcomes. Despite these efforts, malaria remains common in many impoverished countries, owing in part to the absence of a reliable vaccine. Vaccination efforts in places like Pakistan and Nigeria have been hampered owing to civil upheaval and the killing of vaccinators by factions suspicious of modern medicine (Smith, 2013).

The first human infectious illness to be eliminated worldwide was smallpox. Because of the possibility of release and weaponization, it is still a clinical worry. The virus that causes smallpox belongs to the poxvirus family, the genus orthopoxvirus, and the species variola virus. High fever, chills, vomiting, stomach discomfort, headache, and backache are all symptoms of this infection. The skin lesions begin on the forearms or face and spread to the rest of the body 1-3 days later. This exercise depicts the diagnosis and treatment of smallpox, as well as the involvement of the interprofessional team in the care of persons who are afflicted with the disease (Simonsen & Snowden, 2017).

Smallpox's history is remarkable, from its possible inception 3000 to 6000 years ago until its universal eradication in 1978. Smallpox is still a dreaded disease that has killed millions of people and left

countless others deformed. The successful smallpox eradication effort of the World Health Organization in the 1960s and 1970s is discussed. This program's personal experience in Bangladesh in 1973, as well as the laboratory escape of the main smallpox virus in Birmingham in 1978, are described (Geddes, 2006)

Reference

1. Ali, U., Bilal, A., & Fatima, U. (2021). Consumption of Meat and the Human Health. *J Med Res Surg*, 2(3), 1-3.
2. Chepurnov A.A. Ternovoi V.A. Dadaeva A.A. et al. Immunobiological properties of vp24 protein of Ebola virus expressed by recombinant vaccinia virus. *VoprVirusol*. 1997; 42: 115-120 <https://PMID:9297340>
3. Chernos V.I. Vovk T.S. Ivanova O.N. et al. Insertion mutants of the vaccinia virus. The effect of inactivating E7R and D8L genes on the biological properties of the virus. *Mol Gen MikrobiolVirusol*. 1993; : 30-34 <https://doi.org/10.1016/j.ijid.2004.09.004>
4. Cheshenko N.V. Petrov V.S. Protopopova E.V. et al. Recombinant vaccinia virus expressing Japanese encephalitis virus protein E. *Mol Gen MikrobiolVirusol*. 1997; : 24-27 [https://doi:10.1016/0042-6822\(91\)90034-9](https://doi:10.1016/0042-6822(91)90034-9).
5. Bilal, A., Iqbal, A., Rauf, A., Ali, A., & Azam, A. R. (2021). Top Outbreaks of 21st Century: A Review. *Palliat Med Care Int J*, 4(2), 555632.
6. Dixon C.W. Smallpox in Trpolitania, 194. an epidemiological and clinical study of 500 cases, including trials of penicillin treatment. *J Hyg.* 1948; 46: 351-377 <https://doi:10.1017/s0022172400036536>.
7. Ellner, P. (1998) Smallpox: gone but not forgotten. *Infection*, 26(5), 263-269. <https://doi:10.1007/BF02962244>.
8. Bilal, A., & Ullah, M. K. (2021). Impacts of covid. *Journal of Wildlife and Ecology*, 5(3), 135-138.
9. Eyler, J. M. (2003) Smallpox in history: the birth, death, and impact of a dread disease. *The Journal of laboratory clinical medicine*, 142(4), 216-220. [https://doi:10.1016/S0022-2143\(03\)00102-1](https://doi:10.1016/S0022-2143(03)00102-1).
10. Geddes, A. M. (2006). The history of smallpox. *Clinics in dermatology*, 24(3), 152-157. <https://doi:10.1016/j.clindermatol.2005.11.009>.

11. Bilal, A., Iftikhar, A., Ali, U., Naveed, N., Anjum, M. I., Fatima, U., ... & Sajjad, M. K. (2021). Comparison of Different Covid-19 Vaccines Globally: An Overview. *J Gynecol Women's Health*. 21(5): 556071. DOI: 10.19080/JGWH.2021.21.556071
12. Henderson D.A. Inglesby T.V. Bartlett J.G. Smallpox as a Biological Weapon, *Medical and Public Health Management. JAMA*. 1999; 281: 2127-2137 <https://doi:10.1001/jama.281.22.2127>.
13. Henderson, D. A. (2011) The eradication of smallpox—an overview of the past, a focus on vaccines. *Expert review of vaccines*, 15(9), 1197-1211. Resent, and future. *Vaccine*, 29, D7-D9. <https://doi:10.1016/j.vaccine.2011.06.080>
14. Hildreth, C. J., Burke, A. E., & Glass, R. M. J. (2009) Smallpox. 301(10), 1086-1086. <https://doi:10.1056/NEJM198703123161106>.
15. Janoff E.N. Lynfield R. Smallpox: remembrance of things past, or the coming plague?. *J Lab Clin Med*. 2003; 142: 211-215. [https://doi:10.1016/S0022-2143\(03\)00152-5](https://doi:10.1016/S0022-2143(03)00152-5).
16. Kinney R.M. Esposito J.J. Mathews J.H. et al. Recombinant vaccinia virus/Venezuelan equine encephalitis (VEE) virus protects mice from peripheral VEE virus challenge. *J Virol*. 1988; 62: 4697-4702 <https://PMID:3184276>
17. Shah, S. A. H., Bilal, A., Ahmad, M. M., & Bukhari, S. S. (2022). Deforestation Is Causing a Great Loss in Avian Diversity in Pakistan. *American Journal of Zoology*, 5(3), 24-29.
18. Kowalek A. Rudikoff D. A spotlight on smallpox. *Clin Derm*. 2002; 20: 376-387. [https://doi:10.1016/s0738-081x\(02\)00249-3](https://doi:10.1016/s0738-081x(02)00249-3)
19. Milton, D. M. (2012) What was the primary mode of smallpox transmission? Implications for biodefense. *Frontiers in cellular infection microbiology*, 2, 150. <https://doi.org/10.3389/fcimb.2012.00150>
20. Panicali D. Davis S.W. Weinberg R.L. Paoletti E. Construction of live vaccines by using genetically engineered poxviruses: biological activity of recombinant vaccinia virus expressing influenza virus hemagglutinin. *Proc Natl AcadSci USA*. 1983; 80: 5364-5368 <https://doi:10.1073/pnas.80.17.5364>.
21. Bilal, A. (2021). Rabies is a Zoonotic Disease: A Literature Review. *Occup Med Health Aff*, 9(334), 2.
22. Semba, R. D. (2003). The ocular complications of smallpox and smallpox immunization. *Archives of ophthalmology*, 121(5), 715-719. <https://doi:10.1001/archophth.121.5.715>
23. Shchelkunov S.N. Blinov V.M. Sandakhchiev L.S. Genes of variola and vaccinia viruses necessary to overcome the host protective mechanisms. *FEBS Letters*. 1993; 319: 80-83. [https://doi:10.1016/0014-5793\(93\)80041-r](https://doi:10.1016/0014-5793(93)80041-r).

24. Smith, K. A. (2013). Smallpox: can we still learn from the journey to eradication?. *The Indian journal of medical research*, 137(5), 895.
25. Stewart, A. J., & Devlin, P. M. (2006). The history of the smallpox vaccine. *Journal of infection*, 52(5), 329-334. <https://doi:10.1016/j.jinf.2005.07.021>
26. Voigt, E. A., Kennedy, R. B., & Poland, G. A. J. (2016) Defending against smallpox. <https://doi:10.1080/14760584.2016.11753>
27. Whitley R. Smallpox: a potential agent of bioterrorism. *Antivir Res.* 2003; 57: 7-12. [https://doi:10.1016/s0166-3542\(02\)00195-x](https://doi:10.1016/s0166-3542(02)00195-x)
28. Sviatchenko V.A. Agapov E.V. Urmanov I.K. The immunogenic properties of a recombinant vaccinia virus with an incorporated DNA copy of the 26SRNA of Venezuelan equine encephalomyelitis virus. *VoprVirusol.* 1993; 38: 222-226. <https://doi:10.1128/JVI.62.12.4697-4702.1988>.