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Hantavirus: Posing Again and Challenging Mankind On Par with Corona virus

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Abstract

This article is aimed to explore the dark truth about Hantavirus (HV), which is posing again and challenging mankind on par with corona virus. The HV causes Hantavirus pulmonary syndrome (HPS) - a communicable ailment with fever, cough and abdominal pain. The authors collected the information about HV and its origin from books, articles from reputed journals and approved websites. The deadly and troubling HV is again posturing from China and throwing challenge to manhood. The study concludes by giving a fast review on HV, which helps healthcare professionals and making them proactive before one more tragedy arises

Keywords: Hantavirus, animal, airborne, precaution, diagnosis.

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Introduction

Before forgetting corona virus (COVID-19), and its disaster (Huang *et al.*,2020), Hantavirus is posing and challenging the mankind which causes Hantavirus pulmonary syndrome (HPS)- a communicable disease with flu-like manifestations that can headway hastily to hypothetically life-threatening breathing difficulties (Spiropoulou and Srikiatkhachorn, 2013). There is no therapy or vaccine for Hantavirus (HV) (Zhao *et al.*, 2012). Humans gets infected when they exposed to HV infected urine and droppings of rodents get HPS (Meyer and Schmal john, 2000). HPS is a respiratory disease and can be fatal. In May 1993, an outbreak of enigmatic pulmonary sickness happened in the southwestern United States (Sinnott *et al.*, 1993).The development period

for the HV is 2-3 weeks before symptoms and signs appear (Jonsson *et al.,* 2010).The HPS patients, if neglected, may lead to Hantavirus cardiopulmonary syndrome (HCPS) and lead to sudden cardiac arrest (BiI *et al.*, 2008). After much investigation and testing, specialists connected the pulmonary syndrome with a formerly unidentified type of HV. In 2012, ten cases of HV infections were confirmed and made 3 deaths in the USA (NúñezI *et al.*, 2014).Later the outbreak in 2017 of the Seoul virus form of HV took 17 human lives (out of 728 cases) in the United States (HoriganI *et al.*, 2017).Now a new death case reported China (March 2020) with HV (JonssonI *et al.*, 2010).As the viruses go for frequent mutations, which caused difficulty in treating and making vaccines against them (Cross and Burmester, 2006).If this HV is a novel mutated one, then one more deadly virus will pose on par with COVID-19. So, the authors attempted to give awareness and a quick reference to the healthcare professionals and making proactive before one more disaster comes and gives its posture in front of mankind.

Symptoms

HPS develop into two distinct stages. In the first stage, flu-like symptoms viz., fever, chills, headaches, muscle spasms, vomiting, diarrhea, and abdominal pain. At initial phases, HV infection is problematic to differentiate from influenza, pneumonia or other viral illnesses. After 4-10 days, more-serious manifestations like cough, shortness of the breath, fluid accumulation in the lungs, hypotension, and heart fibrillation (Hautala *et al.,* 2010).

Causes of HPS

The HV transmitting by gasping airborne elements of diseased rodent urine, feces, and nesting materials that comprise of HV. The Sin Nombre virus and the southern (prototypical) form of the Andes virus is the foundation of the most Spartan forms of HPS. The northern form of the Andes virus (Andes-Nort), Laguna Negra virus (LNV), and the Choclo virus cause milder forms of HPS (Vapalahti *et al.*,2003).

Mode of transmission

In the U.S., deer mice (*Peromyscus maniculatus*), rats, and mouse do carry HV. Rodents shed the HV in their saliva, urine, and feces. When broom/cleaning of the fresh infectious droppings/urine of these animals HC becomes airborne. The spread of the HV to humans happens when air contaminated with the HV is inhaled. Later HV reaches to lungs, which stimulate respiratory issues, then into the blood, and become lethal (Kallio *et al.*, 2006).

Persons sick with the North American strain of HPS was not transmissible to other people. Conversely, definite outbreaks in South America HV revealed the indication of being conveyed from person to person which is

deadly that exemplifies disparity across strains in the diverse regions.

The other probable ways of the spread of HV is the bite from an infected animal, contacting with diseased rodent urine, feces, or saliva, and consuming food polluted by infected animal urine, droppings/saliva (Byers, 2018).

Diagnosis

After having the symptoms of HPS, the blood tests can disclosethe developed antibodies in contrast to HV. The detailed diagnosis is illustrated here. Laboratory tests for identification of viral contamination fall under molecular tests, and serological tests (HedmanI *et al*., 1991; VaheriI *et al*., 2008; HjelleI *et al*., 2010).

Molecular tests

Reverse transcription-polymerase chain reaction (RT-PCR)

These are further two types one-step, and two-step RT-PCR. The quantification of the RT-PCR are of Endpoint RT-PCR (Relative, competitive, and comparative RT-PCR), Real-time RT-PCR (measuring variations in gene expression of SYBR Green, TaqMan probes, Molecular Beacons, and Scorpions), and Radiological test (Computed Tomography and Chest X-Ray)

Serological test

These include as follows

ELISA (Enzyme-linked immunosorbent assay)

This test quantitatively determines proteins and antigens. Target-specific ELISA kits are accessible from the market.

Serum Lactate Dehydrogenase (LDH)

LDH is an enzyme-bound in almost all tissues of the body acts as a vital character in the metabolic process but in cases of tissue damage due to lack of oxygen supply, this impetus is unrestricted into the blood-stream. The elevated levels of LDH are being observed on a hike in a patient with lung infections and extra pulmonary disorders. The normal ranges for New-born (160-450), Infant (100-250), Children (60-170), and adults (100-190)

Serum Creatine Kinase (CK)

Its release from the muscular activity including cardiac muscle. 22-198 units/L indicates the normal and >198 indicates an abnormal condition.

Other diagnostic tests for the confirmation of the viral infection

Few more diagnostic tests are available for testing viruses are listed below.

Pulse oximetry

The normal values of pulse oximetry are as follows;

Oxygen saturation 75-100 mmHg = normal

Oxygen saturation <60 mm Hg =Abnormal (supplemental oxygen required).

Pulse oximetry 95-100 % = Normal

Pulse oximetry <90% = Abnormal

Arterial blood gas (ABG)

The normal values of arterial blood gas are as illustrated below;

pH: 7.35-7.45

The partial pressure of oxygen (PaO_2): 75-100 mm Hg

The partial pressure of carbon dioxide ($PaCO_2$): 35-45 mm Hg.

Coagulation screen test

The normal values are as follows;

Platelet count: 150,000-450,000 cells/µl (normal); <150,000 (thrombocytopenia)

Bleeding time: 2-7 min (normal)

Prothrombin ratio: 11-13.5 sec

Activated partial thromboplastin time: 60-80 sec

Procalcitonin test

It's a differential diagnosis test used for the confirmation of the symptoms; this test measures the levels of inflammatory biomarkers whose levels rise in the blood in cases of heavy bacterial or viral load. The normal ranges are <0.10 (no systemic inflammatory response), 0.10-0.49 (Minor local infection), 0.50-1.99 (Moderate risk to systemic infection), 2.00-9.99 (Increased risk to systemic infection), and >10.00 (Septic shock).

C-reactive protein

The range of C-reactive protein in blood is <10mg/L, whereas >10mg/L, indicates Abnormal (serious infection).

Troponin T

The troponin T levels are elevated in circumstances like cardiac injuries (owing to exacerbation by chronic obstructive pulmonary disease), which is observed as a symptom of 19CoV. The value below 0.04ng/ml indicates normal and above indicates the heart attack.

Treatment

Unfortunately, there is no specific treatment for HPS. Supportive care can include oxygen therapy(Jonsson*et al.*,2008)fluid replacement, and blood pressure medications. HPS is fatal if not early intervened.

Prevention

Avoid the exposure by keeping rodents out of the home/workplace, and the following tips to be followed (KrügerI *et al*., 2001; Prist *et al.*, 2016).

– Block access of the mice by closing their holes.

– Wash the dishes promptly, clean animal counters/floors with disinfectants.

– Store food in rodent-proof containers.

– Use close-fitting lids on trash cans.

– Set traps, rather using poison in killing the troubling rats.

Conclusion

Hantavirus should not be neglected, as they undergo mutation, and it will be more lethal when it transmits to person to person. At most

care must be taken in disinfecting the premises and sanitizing the hands after handling pet or laboratory animals. Maintaining hygienic conditions, using nose masks, and preventing the exposure rather than get treated after infected.

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Conflict of interest

The authors declare no conflict of interest

Disclosure statement

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References

1. Huang, C., Wang, Y., Li, X., Ren, L., Zhao, J., Hu, Y., ... & Cheng, Z. (2020). Clinical features of patients infected with 2019 novel coronavirus in Wuhan, China. *The Lancet*, *395*(10223), 497-506.

2. Spiropoulou, C. F., &Srikiatkhachorn, A. (2013). The role of endothelial activation in dengue hemorrhagic fever and hantavirus pulmonary syndrome. *Virulence*, *4*(6), 525-536.

3. Zhao, C., Sun, Y., Zhao, Y., Wang, S., Yu, T., Du, F., ... & Luo, E. (2012). Immunogenicity of a multi-epitope DNA vaccine against hantavirus. *Human vaccines &immunotherapeutics*, *8*(2), 208-215.

4. Meyer, B. J., and Schmaljohn, C. S. (2000). Persistent hantavirus infections: characteristics and mechanisms. *Trends in microbiology*, *8*(2), 61-67.

5. Sinnott, J. T., Greene, J. N., Kim, E., &Gompf, S. (1993). Hantavirus: an old bug learns new tricks. *Infection Control & Hospital Epidemiology*, *14*(11), 661-664.

6. Jonsson, C. B., Figueiredo, L. T. M., &Vapalahti, O. (2010). A global perspective on hantavirus ecology, epidemiology, and disease. *Clinical microbiology reviews*, *23*(2), 412-441.

7. Bi, Z., Formenty, P. B., & Roth, C. E. (2008). Hantavirus infection: a review and global update. *The Journal of Infection in Developing Countries*, *2*(01), 003-023.

8. Núñez, J. J., Fritz, C. L., Knust, B., Buttke, D., Enge, B., Novak, M. G., ... &Ströher, U. (2014). Hantavirus infections among overnight visitors to Yosemite National Park, California, USA, 2012. *Emerging infectious diseases*, *20*(3), 386.

9. Horigan, V., Gale, P., Kosmider, R. D., Minnis, C., Snary, E. L., Breed, A. C., & Simons, R. R. (2017). Application of a quantitative entry assessment model to compare the relative risk of incursion of zoonotic bat-borne viruses into European Union Member States. *Microbial Risk Analysis*, *7*, 8-28.

10. Jonsson, C. B., Figueiredo, L. T. M., &Vapalahti, O. (2010). A global perspective on hantavirus ecology, epidemiology, and disease. *Clinical microbiology reviews*, *23*(2), 412-441.

11. Cross, D., &Burmester, J. K. (2006). Gene therapy for cancer treatment: past, present and future. *Clinical medicine & research*, *4*(3), 218-227.

12. Hautala, T., Mähönen, S. M., Sironen, T., Hautala, N., Pääkkö, E., Karttunen, A., ... &Rytky, S. (2010). Central nervous system-related symptoms and findings are common in acute Puumala hantavirus infection. *Annals of medicine*, *42*(5), 344-351.

13. Vapalahti, O., Mustonen, J., Lundkvist, Å., Henttonen, H., Plyusnin, A., &Vaheri, A. (2003). Hantavirus infections in Europe. *The Lancet infectious diseases*, *3*(10), 653-661.

14. Kallio, E. R., Klingström, J., Gustafsson, E., Manni, T., Vaheri, A., Henttonen, H., ... &Lundkvist, Å. (2006). Prolonged survival of Puumala hantavirus outside the host: evidence for indirect transmission via the environment. *Journal of General Virology*, *87*(8), 2127-2134.

15. Byers, K. B. (2018). Zoonotic infections from Hantavirus and Lymphocytic Choriomeningitis Virus (LCMV) associated with rodent colonies that were not experimentally infected. *Applied Biosafety*, *23*(3), 143-152.

16. Hedman, K., Vaheri, A., &Brummer-Korvenkontio, M. (1991). Rapid diagnosis of hantavirus disease with an IgG-avidity assay. *The Lancet*, *338*(8779), 1353-1356.

17. Vaheri, A., Vapalahti, O., &Plyusnin, A. (2008). How to diagnose hantavirus infections and detect them in rodents and insectivores. *Reviews in medical virology*, *18*(4), 277-288.

18. Hjelle, B., & Torres-Pérez, F. (2010). Hantaviruses in the Americas and their role as emerging pathogens. *Viruses*, *2*(12), 2559-2586.

19. Jonsson, C. B., Hooper, J., & Mertz, G. (2008). Treatment of hantavirus pulmonary syndrome. *Antiviral research*, *78*(1), 162-169.

20. Krüger, D. H., Ulrich, R., &Lundkvist, Å. (2001). Hantavirus infections and their prevention. *Microbes and infection*, *3*(13), 1129-1144.

21. Prist, P. R., Uriarte, M., Tambosi, L. R., Prado, A., Pardini, R., D´ Andrea, P. S., & Metzger, J. P. (2016). Landscape, environmental and social predictors of Hantavirus risk in São Paulo, Brazil. *PloS one*, *11*(10), e0163459.