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Hantaviruses and Human Disease: A Concise Overview

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ABSTRACT

Hantaviruses are globally distributed zoonotic RNA viruses that spill over from chronically infected rodents, causing HFRS and HPS/HCPS with high mortality driven by capillary leak and organ failure. There is still no globally effective, specific treatment or vaccine, so reducing rodent exposure, maintaining strong surveillance, and providing early, high-quality supportive care remains the main tools to limit severe disease and death. The aim of this article is to know the brief overview of hantaviruses as major global public health threats causing HPS and HFRS.

Keywords: Hantaviruses, HPS, HFRS, globally

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Introduction

Hantaviruses are rodent-borne RNA viruses that cause severe zoonotic disease, sometimes fatal, in humans worldwide. Infection follows exposure to aerosols from urine, feces, or saliva of persistently infected rodents; Andes virus is a notable exception with documented person-to-person spread (1). Hantaviruses are under the family Hantaviridae and the order Bunyavirales (1,2). They mainly produce two syndromes: hemorrhagic fever with renal syndrome (HFRS) and hantavirus pulmonary/cardiopulmonary syndrome (HPS/HCPS), both marked by fever and damage to small blood vessels leading to fluid leakage and organ failure and no globally approved specific antiviral treatment (1, 2, 3). The CDC is responding to a deadly outbreak of Andes virus, a type of hantavirus, among passengers and crew of a cruise ship in the Atlantic Ocean (4).

Both HFRS and HCPS are characterized by infection of endothelial cells, leading to increased capillary permeability, acute thrombocytopenia, hypotension or shock, and organ dysfunction, particularly of the kidneys in HFRS and the lungs in HCPS (1, 2). Disease severity ranges from mild nephropathia epidemica due to Puumala virus to severe forms associated with Hantaan, Dobrava, and New World hantaviruses, with HFRS case fatality around 5–15% for the most virulent agents and HCPS fatality up to 40% (1, 3). This article's central aim is to provide an updated, focused overview of how hantavirus infections can be treated or prevented by gathering current knowledge on antivirals, antibody-based therapies, RNAi approaches, and vaccine candidates and by stressing their potential to limit severe disease and improve public health.

Virology and Transmission

- Hantaviruses are enveloped, negative-sense, tri-segmented RNA viruses in the family Hantaviridae (5, 6).
- Reservoirs: Persistently infect rodents, usually without illness; virus is shed in urine, feces, and saliva (7, 8).
- Human infection: Mainly by inhaling contaminated aerosols from rodent excreta; bites and contaminated food are fewer common routes (2, 9).
- Unique case: Andes virus can spread person-to-person (1).

Epidemiology and Transmission

Burden: 150,000–200,000 HFRS cases/year (mostly Asia); ~200 HCPS cases/year in the Americas, with ~40% case-fatality in HCPS and 1–15% in HFRS depending on virus (7,8).

Reservoirs: Persistent, asymptomatic infection in specific rodent species; humans infected mainly by inhaling aerosolized urine, feces, or saliva in rodent-infested settings (1,8).

Special case: Andes virus allows person-to-person transmission, unlike other hantaviruses (1)

Risk factors: Rural exposures, occupational contact, disturbed environments, and conflict settings (e.g., Ukraine) increase risk and underdiagnosis (1, 6).

Pathogenesis and Clinical Manifestations

- Hantaviruses mainly infect endothelial cells, causing increased capillary permeability, thrombocytopenia, and shock (7, 10).
- HFRS: Acute fever, vascular leakage into retroperitoneum, acute kidney injury, and hemorrhagic signs (1, 11)
- HPS/HCPS: Rapid onset respiratory failure with non-cardiogenic pulmonary edema, hypotension, and shock (1, 12).
- Both are largely immunopathologic, with overactive immune responses and cytokines (e.g., TNF, IFN-γ) contributing to leakiness of vessels (1, 13).

Diagnosis

Often delayed due to nonspecific early symptoms; rapid serology or molecular tests and high clinical suspicion are crucial, especially in severe respiratory disease with thrombocytopenia and renal involvement (14, 15).

Treatment and prevention

- No specific, widely approved antiviral therapy or globally effective vaccine exists; management is primarily high-quality supportive and critical care, including renal replacement therapy and mechanical ventilation or extracorporeal membrane oxygenation in severe cases. Prevention relies on rodent control, reduction of human–rodent contact, and public health education, while multiple vaccine platforms and antiviral candidates (e.g., ribavirin, favipiravir, neutralizing antibodies, RNA-based approaches) are under active investigation (16, 17).
- Rodent control; reduce shelters and food near homes; avoid cleaning rodent-infested spaces without protection (7, 18).

Conclusion

Hantaviruses are globally distributed zoonotic RNA viruses that spill over from chronically infected rodents to humans, causing HFRS and HPS/HCPS. Both syndromes share a core mechanism of capillary leak, thrombocytopenia, and potentially fatal organ failure. With no globally available, highly effective vaccines or proven curative antivirals, control currently depends on rodent exposure prevention, early clinical recognition, and high-quality supportive care while vaccine and therapeutic research continues.

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