

Viral Hemorrhagic Fevers (VHFs)

VHFs are a group of illnesses caused by four main virus families: Arenaviridae, Bunyaviridae, Filoviridae, and Flaviviridae.

Characteristics:

Damage to the vascular system.

Often causes bleeding (severity varies by disease).

Ranges from mild to severe; e.g., Ebola and Marburg have high mortality rates.

Symptoms:

Early signs include fever and bleeding beneath the skin (petechiae, ecchymosis).

Advanced stages involve internal and external bleeding from orifices.

Virus Families and Key Diseases

Arenaviridae:

Diseases: Lassa Fever, Argentine HF (Junin), Bolivian HF (Machupo), Brazilian HF (Sabia), Venezuelan HF (Guanarito).

Bunyaviridae:

Diseases: Rift Valley Fever (RVF), Crimean-Congo HF (CCHF), Hantavirus (causing HFRS and HPS).

Filoviridae:

Diseases: Ebola (Ebola-Zaire, Ebola-Sudan, Ebola-Ivory Coast, etc.), Marburg virus.

Flaviviridae:

Diseases: Yellow Fever, Dengue Fever, Omsk HF, Kyasanur Forest Disease.

Geographical Distribution:

Arenaviridae: West Africa (Lassa Fever), South America (other Arenaviridae diseases).

Filoviridae: Mostly found in Africa (Ebola, Marburg).

Flaviviridae: Found in South America as well as West Africa (Yellow fever, dengue).

Transmission of VHF

Common Transmission Routes:

Rodents & Arthropods: Natural reservoirs and vectors.

Bites: From infected mosquitoes or ticks.

Inhalation: Rodent excreta.

Person-to-Person: Blood and body fluids; occurs in Filoviridae, Hantavirus, Congo virus and Lassa Fever.

Animal Products: Exposure to infected animals or tissues.

Arboviruses: Transmitted by arthropods (mosquitoes/ticks); includes Bunyaviridae and Flaviviridae.

Non-Arboviruses: Includes hantavirus (zoonotic, non-arthropod).

Common Characteristics of VHF

General Features:

Enveloped, single-strand RNA viruses.

Zoonotic (animal-borne) with geographic restriction due to natural hosts.

Some are segmented, like Bunyaviridae.

Hosts: Rodents, bats, mosquitoes, ticks, livestock, primates.

Pathology:

Can cause diffuse vascular damage due to increased vascular permeability and cytokine activation.

Arenaviridae Details

General Characteristics:

Enveloped, segmented RNA viruses replicating in the cytoplasm.

Rodents are primary reservoirs; virus shed in urine, feces.

Human Infection:

Contact with contaminated materials, aerosol transmission, or direct contact.

Stages:

Prodromal Stage: Fever, headache, joint pain.

Toxemia Phase: Bleeding diathesis, DIC, and continuous bleeding.

Lassa Fever:

Symptoms: Retro-sternal pain, pharyngitis, potential hearing loss, spontaneous abortion.

Treatment: Ribavirin, supportive care.

Bunyaviridae Details

Segmented RNA Virus: Consists of L (large), M (medium), and S (small) segments.

Transmission:

RVF: Aedes Egypti mosquitoes.

CCHF: Ixodid ticks (Hyalomma).

Hantavirus: Rodent excreta (not transmitted by arthropods).

Key Diseases:

Rift Valley Fever: Mild illness in humans, occasional vision loss, <1% mortality.

Crimean-Congo HF: High mortality (15-40%), transmitted via ticks and aerosols.

Hantavirus: Causes HFRS in Old World, HPS in New World.

Flaviviridae Details

General Characteristics:

RNA viruses, arboviruses, transmitted mainly by mosquitoes.

Includes Yellow Fever, Dengue, Omsk HF, Kyasanur Forest Disease.

Transmission:

Yellow Fever and Dengue: Aedes mosquitoes.

Kyasanur Forest Disease: Ixodid tick.

Key Diseases:

Yellow Fever: Biphasic, involves liver and jaundice, mortality 15-50%.

Dengue: Four serotypes; can cause Dengue Hemorrhagic Fever and Dengue Shock Syndrome (high fatality in DSS).

Filoviridae Details

General Characteristics:

Filoviridae diseases (Ebola, Marburg) have some of the highest mortality rates (up to 90%).

Often transmitted by contact with infected tissues or bodily fluids.

Key Diseases:

Ebola: 5 subtypes; symptoms include acute onset, gastrointestinal involvement, and severe weight loss.

Marburg: Symptoms include chest pain, rash, pancreatitis, jaundice; mortality 21-90%.

Biosafety: Level 4 containment required due to high transmissibility and fatality.

Common Pathophysiology of VHFs

Vascular Compromise:

Small vessel involvement leading to increased permeability and shock.
Cytokine storm, abnormal vascular regulation.

Two-Part Mechanism:

Viremia Phase: Systemic symptoms (fever, myalgia) due to cytokine activation.

Immune Response Phase: Endothelial injury, clotting factor consumption, and bleeding.

Clinical Features of VHFs

Early/Prodromal Symptoms:

Fever, myalgia, malaise, headache, nausea, non-bloody diarrhea.

Progressive Signs:

Conjunctivitis, pharyngitis, flushing, edema, petechiae, ecchymosis.

Severe/End-Stage:

Multisystem compromise, DIC, shock, encephalopathy, death.

Laboratory Studies for VHFs

1. Complete Blood Count: Leukopenia, thrombocytopenia, DIC.

2. Liver Enzymes: Especially elevated in Yellow Fever.

3. Kidney Function: Particularly relevant for HFRS (Hantavirus).

4. Serological Tests: Antibodies may be undetectable in the acute phase.

5. Virus Detection: RT-PCR, electron microscopy for Arenaviridae, cell culture (Biosafety Level 4).

Treatment of VHFs

Supportive Care: Core approach involving fluid/electrolyte management, hemodynamic monitoring.

Management of Bleeding:

Cryoprecipitate, platelets, fresh frozen plasma.

Heparin in cases of DIC.

Antiviral Use:

Ribavirin for Lassa Fever, some Bunyaviridae (limited evidence for others).

Prevention and Control

Nosocomial Precautions: Complete sterilization, protective clothing.

Vector and Host Control:

For non-arthropod-borne VHFs, controlling rodent populations is essential.

For arthropod-borne VHFs, reducing mosquito/tick populations is key.

Vaccination:

Yellow Fever: Only approved VHF vaccine, recommended for travelers.

Experimental vaccines in development for Argentine HF, Rift Valley Fever, and Dengue.

VHFs as Bioweapons

Reasons for Concern:

High morbidity and mortality.

Low infectious dose, aerosol transmission potential.

Public fear and panic, limited vaccine availability.

