Viral hepatitis is a systemic disease primarily involving the liver. Most cases of acute viral hepatitis in children and adults are caused by one of the following five agents: hepatitis A virus (HAV), the etiologic agent of viral hepatitis type A (infectious hepatitis); hepatitis B virus (HBV), which is associated with viral hepatitis B (serum hepatitis); hepatitis C virus (HCV), the agent of hepatitis C (common cause of posttransfusion hepatitis); hepatitis D (HDV), a defective virus dependent on coinfection with HBV; or hepatitis E virus (HEV), the agent of enterically transmitted hepatitis.

PROPERTIES OF HEPATITIS VIRUSES

The five hepatitis viruses are classified in different virus families and genera, varying in virion, genome properties, and replication patterns.
The characteristics of the five known hepatitis viruses are shown in Table -1 .
Nomenclature of the hepatitis viruses, antigens, and antibodies is presented in Table -2 .

Table -1 Characteristics of Hepatitis Viruses

Virus	Hepatitis A	Hepatitis B	Hepatitis C	Hepatitis D	Hepatitis E
Family	Picornaviridae	Hepadnaviridae	Flaviviridae	Unclassified	Hepeviridae
Genus	*Hepatovirus*	*Orthohepadnavirus*	*Hepacivirus*	*Deltavirus*	*Hepevirus*
Virion	27 nm, icosahedral	42 nm, spherical	60 nm, spherical	35 nm, spherical	30–32 nm, icosahedral
Envelope	No	Yes (HBsAg)	Yes	Yes (HBsAg)	No
Genome	ssRNA	dsDNA	ssRNA	ssRNA	ssRNA
Genome size (kb)	7.5	3.2	9.4	1.7	7.2
Stability	Heat and acid stable	Acid sensitive	Ether sensitive, acid sensitive	Acid sensitive	Heat stable
Transmission	Fecal–oral	Parenteral	Parenteral	Parenteral	Fecal–oral
Prevalence	High	High	Moderate	Low, regional	Regional
Fulminant disease	Rare	Rare	Rare	Frequent	In pregnancy
Chronic disease	Never	Often	Often	Often	Never
Oncogenic	No	Yes	Yes	?	No

ds, double stranded; HBsAg, hepatitis B surface antigen; ss, single stranded.

Table-2: Nomenclature and Definition of Hepatitis Viruses, Antigens, and Antibodies

Disease	Component of System	Definition
Hepatitis A	HAV	Hepatitis A virus. Etiologic agent of infectious hepatitis. A picornavirus, the prototype of genus *Hepatovirus*
	Anti-HAV	Antibody to HAV. Detectable at onset of symptoms; lifetime persistence
	IgM anti-HAV	IgM class antibody to HAV. Indicates recent infection with hepatitis A; positive result up to 4–6 months after infection
Hepatitis B	HBV	Hepatitis B virus. Etiologic agent of serum hepatitis. A hepadnavirus
	HBsAg	Hepatitis B surface antigen. Surface antigen(s) of HBV detectable in large quantity in serum; several subtypes identified
	HBeAg	Hepatitis B e antigen. Associated with HBV nucleocapsid; indicates viral replication; circulates as soluble antigen in serum
	HBcAg	Hepatitis B core antigen
	Anti-HBs	Antibody to HBsAg. Indicates past infection with and immunity to HBV, presence of passive antibody from HBIG, or immune response from HBV vaccine
	Anti-HBe	Antibody to HBeAg. Presence in serum of HBsAg carrier suggests lower titer of HBV
	Anti-HBc	Antibody to HBcAg. Indicates infection with HBV at some undefined time in the past
	IgM anti-HBc	IgM class antibody to HBcAg. Indicates recent infection with HBV; positive result for 4–6 months after infection
Hepatitis C	HCV	Hepatitis C virus, a common etiologic agent of posttransfusion hepatitis. A flavivirus, genus *Hepacivirus*
	Anti-HCV	Antibody to HCV
Hepatitis D	HDV	Hepatitis D virus. Etiologic agent of delta hepatitis; causes infection only in presence of HBV
	HDAg	Delta antigen (delta-Ag). Detectable in early acute HDV infection
	Anti-HD	Antibody to delta-Ag (anti-delta). Indicates past or present infection with HDV
Hepatitis E	HEV	Hepatitis E virus. Enterically transmitted hepatitis virus. Causes large epidemics in Asia, North and West Africa, and Mexico; fecal–oral or waterborne transmission. A hepevirus
Immune globulins	IG	Immune globulin USP. Contains antibodies to HAV; no antibodies to HBsAg, HCV, or human immunodeficiency virus
	HBIG	Hepatitis B immune globulin. Contains high titers of antibodies to HBV

Replication of hepatitis viruses

RNA hepatitis viruses replicate in cytoplasim while Hepatitis B replication accure in both nucleus and cytoplasim.

Hepatitis virus Transmission

HAV and HEV are transmitted by fecal–oral exposures; HBV, HCV, and HDV are transmitted by parenteral routes.

HAV causes outbreaks of disease, often in camps or institutions.
Whereas HBV, HCV, and HDV frequently establish chronic infections, HAV and HEV do not.

Most individuals infected with HBV as infants develop chronic infections and are at risk for liver disease as adults.
The majority of HCV infections lead to chronic infections even in adults; those individuals are at risk of later development of liver disease, the disease associated with HCV is the most frequent cause for adult liver transplantation.

HDV superinfections of HBV carriers may lead to highly fatal fulminant hepatitis.
HBV and HCV are both causes of liver cancer that may arise many years after infection.

Pathology

Hepatitis is a general term meaning inflammation of the liver. Microscopically, there is spotty parenchymal cell degeneration, with necrosis of hepatocytes, a diffuse lobular inflammatory reaction, and disruption of liver cell cords.

Clinical and laboratory features

Hepatitis viruses produce acute inflammation of the liver, resulting in a clinical illness characterized by fever>38°, gastrointestinal symptoms such as nausea and vomiting, and jaundice. Serologic markers help determine the causative agent of individual cases of hepatitis.

aminotransferase elevation, Immunoglobulins (IgM levels) elevated in hepatitis A while in case of hepatitis B and C is normal to slightly elevated.
Regardless of the virus type, identical histopathologic lesions are observed in the liver during acute disease, serological markers for hepatitis viruses illustrated in Table-3.

Table-3: Interpretation of Hepatitis viruses Serologic Markers in Patients with Hepatitis

Assay Results	Interpretation
Anti-HAV IgM positive	Acute infection with HAV
Anti-HAV IgG positive	Past infection with HAV
Anti-HCV positive	Current or past infection with HCV
Anti-HD positive, HBsAg positive	Infection with HDV
Anti-HD positive, anti-HBc IgM positive	Coinfection with HDV and HBV
Anti-HD positive, anti-HBc IgM negative	Superinfection of chronic HBV infection with HDV

Anti-HAV, antibody to hepatitis A virus (HAV); anti-HBc, antibody to hepatitis B core antigen; anti-HCV, antibody to hepatitis C virus (HCV); anti-HD, antibody to hepatitis D virus (HDV); HBcAg, hepatitis B core antigen; HBsAg, hepatitis B surface antigen; HBV, hepatitis B virus; IgG, immunoglobulin G; IgM, immunoglobulin M.

Prevention and Control

Viral vaccines and protective IG preparations are available against HAV and HBV. Neither type of reagent is currently available to prevent HCV infections.

Treatment of patients with hepatitis is supportive and directed at allowing hepatocellular damage to resolve and repair itself.
Only HBV and HCV have specific treatments, and those are only partially effective.
Recombinant IFN-α is currently the therapy of proven benefit in the treatment of patients chronically infected with HBV or HCV.
Several antiviral drugs are available for use against chronic hepatitis infections. With nucleoside and nucleotide analogs, such as lamivudine.

Reference

Brooks G F, Carroll K C, Butel J S, Morse SA&Mietzner TA. (2013). Jawetz, Melnick, &Adelbergs, Medical Microbiology, 26th edition. Section II, PP 130-140. The McGraw-Hill Education. U.S.A.

Prepared by Assist. Prof. Dr. Zainab Khudhur Ahmad Al-Mahdi