The Epidemiology of Hepatitis A, B, and C

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Definitions

- **Epidemiology:**
  - The study of the incidence and prevalence of diseases in large populations and the detection of the source and cause of epidemics of infectious disease.
  - The study of the relationships between exposures such as nutrition, biological agents, stress, or chemicals to outcomes such as disease, wellness, and health indicators.

- **Incidence:**
  - The number of new cases of a disease during a given time interval, usually one year.

- **Prevalence:**
  - The total number of cases of a disease in the population at a given time.

Virus:
- A microscopic particle that can infect the cells of biological organisms. Viruses can replicate themselves only by infecting a host cell. Consist of genetic material contained within a protective protein coat.

Hepatotropic viruses:
- Predominantly infect the liver.
- Hepatitis A, B, C, D, and E.
- AKA: HAV, HBV, HCV, HDV, and HEV.

Incubation period:
- The time between exposure to an infection and when symptoms and signs first occur.

Viral Hepatitis in the US

<table>
<thead>
<tr>
<th></th>
<th>HAV</th>
<th>HBV</th>
<th>HCV</th>
</tr>
</thead>
<tbody>
<tr>
<td>Acute infections</td>
<td>930K</td>
<td>780K</td>
<td>28K</td>
</tr>
<tr>
<td>Acute liver failure</td>
<td>50</td>
<td>100</td>
<td>Rare</td>
</tr>
<tr>
<td>death/year</td>
<td>0</td>
<td>1.25 million</td>
<td>2.8-4 million</td>
</tr>
<tr>
<td>Chronic infections</td>
<td>0</td>
<td>5,000</td>
<td>8,000-10,000</td>
</tr>
<tr>
<td>Chronic liver disease</td>
<td>0</td>
<td></td>
<td></td>
</tr>
<tr>
<td>death/year</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

CDC estimates, 2011.
REPORTED CASES OF SELECTED NOTIFIABLE DISEASES PREVENTABLE BY VACCINATION, UNITED STATES, 2001

<table>
<thead>
<tr>
<th>Disease</th>
<th>Cases</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hepatitis A</td>
<td>10,609</td>
</tr>
<tr>
<td>Hepatitis B</td>
<td>7,843</td>
</tr>
<tr>
<td>Pertussis</td>
<td>7,580</td>
</tr>
<tr>
<td>Meningococcal disease</td>
<td>2,333</td>
</tr>
<tr>
<td>H. influenzae, invasive</td>
<td>1,597</td>
</tr>
<tr>
<td>Mumps</td>
<td>266</td>
</tr>
<tr>
<td>Measles</td>
<td>116</td>
</tr>
</tbody>
</table>

Source: NNDSS, CDC

Geographic Distribution of Hepatitis A Virus Infection

Hepatitis A: Clinical Features

- **Transmission:**
  - Fecal-oral, unsanitary conditions, contaminated food/water, rarely blood.
- **Incubation:**
  - 2 to 6 weeks (average 25 days).
- **Infectivity:**
  - 2 to 3 weeks.
  - > 1 week prior to the onset of symptoms.

Hepatitis A: Epidemiology

- **Prevalence:**
  - > 40% in U.S. have had previous infection.
  - ~ 100% in developing countries.
  - Accounts for 40% of all cases of acute viral hepatitis.
- **Groups at risk:**
  - Children/workers in day-care
  - Homosexual men
  - Residents and traveler in underdeveloped countries
  - No risk factor identified for 40% - 50% of cases.
Hepatitis A: Clinical Course

- Symptoms:
  - Early: fever, nausea and vomiting, fatigue, diarrhea, anorexia.
  - Late: right-upper abdominal pain, dark urine, and jaundice.

- Severity/Natural history:
  - Age dependant.
    - Jaundice by age group:
      - < 6 yrs: <10%
      - 6-14 yrs: 40%-50%
      - > 14 yrs: 70%-85%
  - Recover is the rule: provides life long immunity from future infections.
  - Never causes chronic disease.
  - Rarely may lead to fulminant liver failure (<1:3000).

Hepatitis A: Treatment

- Prevention, prevention, prevention.
- No effective treatment exists:
  - Supportive care.
- Fulminant Liver Failure:
  - Liver transplantation.
- Immune globulin, (IG):
  - For unvaccinated persons, who have recently been exposed to HAV.
  - Must be given within two weeks of exposure to HAV in order to work.

Hepatitis A: Prevention

- Wash hands after using the bathroom, changing a diaper, or before preparing or eating food.
- Hepatitis A vaccines:
  - Provide long-term protection against hepatitis A.
  - High-risk persons (IV drug users, homosexual men, travelers to endemic areas).
  - Chronic liver disease.
  - Transplant recipients.
  - Success rate: >95%.
Hepatitis B: Epidemiology

- 30% of acute viral hepatitis and 15% of chronic viral hepatitis in the US
- Globally
  - 350 million persons infected
  - 75% in Asia
  - > 500,000 deaths per year
- United States
  - 1.25 million persons infected (0.3%)
  - 5-15% of Asian Americans
  - 4-5,000 deaths per year

Hepatitis B: Clinical Features

- Incubation period: Average 60-90 days
  Range 45-180 days
- Clinical illness (jaundice): <5 yrs, <10%
  >5 yrs, 30%-50%
- Acute case-fatality rate: 0.5%-1%
- Chronic infection: <5 yrs, 30%-90%
  >5 yrs, 2%-10%
- Premature mortality from chronic liver disease: 15%-25%
Clinical Features & Natural History

- 95% clear infection and develop lifelong immunity (HBsAg negative, IgG HBc Ab positive).
- 5% HBsAg positive for > 6 month = chronic infection
  - Chronicity: 90% in neonates, 25-50% of children < 6 years old
  - Inactive carrier state (low viral level, normal LFT’s and biopsy)
  - Chronic active hepatitis (elevated LFT’s, necrosis and inflammation on liver biopsy)

Hepatitis B Prevention and Vaccination

- Prevent perinatal HBV transmission
- Vaccination is routine for infants
- Ages 11-15 “catch up”, and through age 18
- Over 18 – high risk groups:
  - Occupational risk (Health care workers)
  - Hemodialysis patients
  - All STD clinic clients
  - Multiple sex partners or prior STD
  - Inmates in Correctional settings
  - MSM
  - IDU
  - Household contacts/sex partners of persons with chronic HBV.
- Post-vaccination testing: 1-2 months after last shot, if establishing response is critical (HCW).

Geographic Distribution of Hepatitis C Virus Infection

Hepatitis C (HCV)

- Hepatitis C is a hepatotropic viral that causes chronic inflammation of the liver.
- Parenteral transmission.
- 20% of persons infected with HCV develop cirrhosis over a 40-50 year period.
- Acute and chronic infection is typically asymptomatic until overt liver failure develops (AKA the “silent killer”)
- HCV has replaced alcoholic liver disease as the leading indication for liver transplantation in the US.
Modes of Transmission

- Sexual contact
- Tattoos, body piercing
- Intranasal drug use
- Injection drug use
- Mother-to-infant
- Occupational exposure
- Nosocomial
- Organ and tissue transplantation
- Blood transfusion prior to 1992
- Blood transfusion prior to 1992
- Prevalence by Risk Factors

Prevalence of HCV

- IDU: 58%
- Non-IDU: 3.5%
- No drugs: 0.7%

Sexual Transmission

- Incubation: 2 to 22 weeks
- Symptoms:
  - 75% asymptomatic, jaundice uncommon
  - Fatigue, right upper quadrant abdominal pain, most common symptoms
  - Chronic infection occurs in 60-85%
  - 30% have normal liver enzymes
  - “silent killer”

Hepatitis C: Clinical Features
NHANES III
(Third National Health and Nutrition Examination Survey)

- HCV seropositivity: (1.8%)
- 3.9 million (3.1-4.8)
- HCV viremia: (0.96%)
- 2.7 million (2.4-3.0)
- Highest observed prevalence: (9.8%)
- black men 40 to 49 years old.
- Incidence: 28,000 new infections annually
- Mortality: 8-10,000 deaths annually

Age Specific Prevalence
NHANES III 1988 - 1994

HCV Prevalence by Age & Ethnicity

Prevalence of HCV Infection by Age, Ethnicity, and Gender, 1988-1994

Source: NHANES III
Estimated Incidence of Acute Hepatitis C
United States, 1982-2000

Source: Sentinel Counties

Natural History of HCV Infection

Leading Indication for Liver Transplant

Hepatitis C : Clinical Course

Predictors
- Age > 40
- > 35 g ETOH
- Male
- Fatty liver
- HIV
- HBV

Progression Depends on Histologic Activity

Poynard, Lancet 1997;349:825-832
Yano, Hepatology 1996;23:1334-1340
**Hepatitis C: Indications for Testing**

- Transfusion prior to 1992
- Hemodialysis
- Multiple sexual partners
- Spouses/partners
- Injection drug use
- Intranasal cocaine use

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**Hepatitis C: Prevention**

- No vaccine available
- Screening and testing donors of blood, organs, and tissues
- Risk-reduction counseling and services
  - Latex condoms if multiple partners
  - Avoid sharing toothbrushes, razors, combs
  - Cover open wounds
- Infection control practices
- Blood and body fluid precautions