Microbiology

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Adenoviruses

- **Introduction**
  - First Isolated: From adenoids surgically removed from children in 1953.
  - Replication & Disease: Can replicate and cause disease in epithelial cells (respiratory, gastrointestinal, urinary tracts, and eye).
  - Subclinical Infections: Many adenovirus infections are subclinical; the virus may persist for months in the host.
  - Research Use: Valuable for molecular and biochemical studies of eukaryotic cell processes and gene therapy.
  - Oncogenic Potential: Some strains are oncogenic to animals but not important in human cancer.

- **Structure**
  - Size: 70–90 nm in diameter.
  - Genome: Linear double-stranded DNA.
  - Terminal Protein: A virus-encoded protein covalently linked to the end of the linear genome.
  - Capsid:
    - ✓ Icosahedral structure with 252 capsomeres.
    - ✓ Composed of hexons (240), pentons (12), and fibers (12) at each vertex.
  - Enveloped: Unenveloped (naked).
  - Infectivity: DNA can be isolated in an infectious form, but infectivity reduces 100-fold if the terminal protein is removed.
  - Major Antigens: Hexons, pentons, and fibers; important in viral classification.
  - Penton Base: Carries a toxin-like activity that causes rapid cytopathic effects.
  - Fibers: Associated with hemagglutinating activity and used for viral typing due to type-specific hemagglutinin.

- **Classification**
  - Human Adenoviruses: At least 57 distinct antigenic types isolated from humans and animals.
    - ✓ About one-third of the 57 known serotypes are responsible for most human diseases.
  - Groups: Divided into seven groups (A–G) based on genetic, physical, chemical, and biological properties.

- **Replication and Pathogenesis**
  - Target Cells: Replicate primarily in epithelial cells (respiratory, gastrointestinal, urinary tract, and eye).
  - Attachment: Virus attaches to cells via fiber structures.
    - ✓ Host cell receptor: CAR (Coxsackie–Adenovirus Receptor), a member of the immunoglobulin gene superfamily.
  - Cytopathic Effect: Causes rounding, enlargement, and aggregation of affected cells into grape-like clusters in human epithelial cell cultures.

- **Epidemiology**
  - Global Presence: Adenoviruses are present worldwide and circulate year-round, with occasional community outbreaks.
  - Transmission:
    1. Respiratory: Via inhalation of respiratory droplets, contaminated hands, or surfaces.
    2. Intestinal: Via the fecal-oral route.
    3. Eye: Through contaminated hands, towels, or ophthalmic instruments.

- **Clinical Manifestations**
  - Diseases Associated with Adenoviruses:
    - ✓ Keratoconjunctivitis (eye infection)
    - ✓ Pharyngo-conjunctival fever
    - ✓ Acute respiratory diseases
    - ✓ Gastroenteritis
    - ✓ Urinary tract infection
    - ✓ Meningitis
  - Respiratory Diseases
    - ✓ Group C, Serotypes 1–7: Common in infants and children.
    - ✓ Symptoms: Fever, sore throat, malaise, hoarseness, and cough.
    - ✓ Pneumonia: Develops in ~10% of cases and can be fatal.
    - ✓ Military Recruits: Adenoviruses cause acute respiratory disease syndrome, with fever, sore throat, nasal congestion, cough, and sometimes pneumonia.
  - Keratoconjunctivitis
    - ✓ Group D, Serotypes 8, 19, and 37:
      - Characterized by aggressive conjunctivitis, pain, photophobia, and lymphadenopathy.
      - Development of superficial punctate keratitis.
  - Gastroenteritis
    - ✓ Group F, Serotypes 40 and 41:
      - Common in young children and neonates.
      - Second most common viral cause of gastroenteritis (7–15% of endemic cases).
      - Similar to rotavirus infections.
      - Most children develop antibodies against enteric adenoviruses by age three.

- **Laboratory Diagnosis**
  - Virus Isolation: Can be isolated from eye swabs, throat swabs, urine, feces, and CSF.
    - ✓ Grown on human embryonic kidney cells, Hep-2 cells, or monkey kidney cells.
  - Antigen Detection:
    - ✓ ELISA, latex agglutination, or immunofluorescence for fastidious enteric adenovirus antigens.
    - ✓ PCR for genetic identification.
  - Serology: A rise in complement-fixing antibodies indicates recent infection.

- **Treatment and Prevention**
  - Treatment: No antiviral drug therapy available; treatment is supportive.
  - Vaccine: Live adenovirus vaccine used in military settings (rarely used elsewhere).
  - Conjunctivitis Prevention: Adequate chlorine levels in swimming pools can prevent swimming pool-associated conjunctivitis.

- **Prognosis**
  - General Outcome: Self-limiting disease with usual recovery.
  - Immunocompromised: Can cause disseminated infections in individuals with weakened immune systems.

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