

Adenoviruses

Classification (Table 1)

Table 1 Classification of adenoviruses

Family	Genera	Species	Serotypes
Adenoviridae	Mastadenovirus	A	12, 18, 31
		B	3, 7, 11, 14, 16, 21, 34, 35, 50, 55
		C	1, 2, 5, 6
		D	8, 9, 10, 13, 15, 17, 19, 20, 22, 23, 24, 25, 26, 27, 28, 29, 30, 32, 33, 36, 37, 38, 39, 42, 43, 44, 45, 46, 47, 48, 49, 51, 53, 54
		E	4
		F	40, 41
		G	55

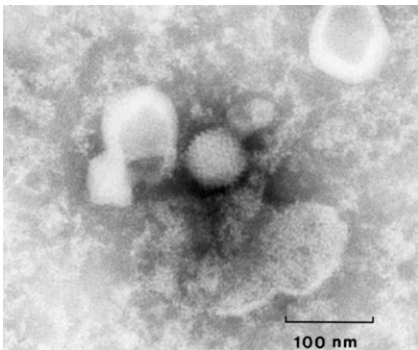


Fig. 2 **Electronmicroscopy of adenoviruses.** (Photo courtesy of Prof M Taylor, University of Pretoria.)

Pathogenesis

Adenoviral infection of target cells results in cell lysis and release of newly formed virions. An inflammatory cell infiltrate and the secretion of various cytokines accompany lytic infection. Infection may also be latent/persistent in the upper respiratory tract (tonsils and adenoids), gastrointestinal tract and lymphocytes, with periodic, asymptomatic shedding of virus in faecal and respiratory secretions.

Clinical picture

See Fig. 4.

Laboratory diagnosis

Faeces, throat swabs, nasopharyngeal aspirates, conjunctival swabs, urine, CSF, blood and tissue biopsies can be submitted to the laboratory for the diagnosis of adenovirus infection. Adenoviruses can be detected in respiratory secretions up to 1 week

Structure (Figs 1 and 2)

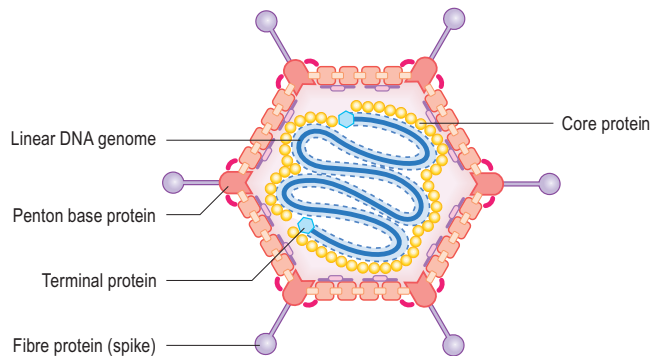


Fig. 1 **Adenovirus structure.**

Replication (Fig. 3)

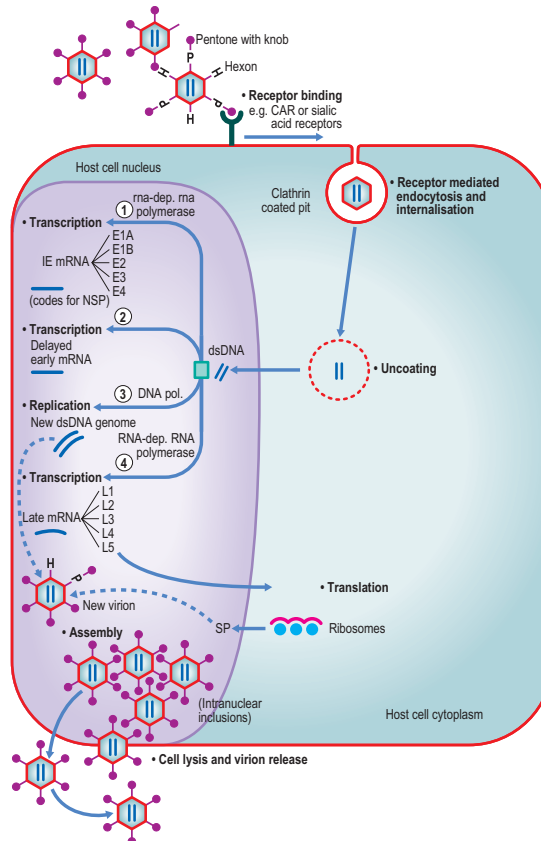


Fig. 3 **Adenovirus replication.**

after the commencement of symptoms, in conjunctival specimens up to 2 weeks after the onset of ocular infection and in urine and stool samples from 2 weeks and up to 12 months after a respiratory or gastrointestinal infection.

Diagnosis may be attempted by means of direct and indirect methods.

Direct methods

- Isolation/culture
 - Human embryonic kidney cells (HEK), hep-2, hela, and A549 cells

are all suitable for the isolation of adenoviruses. Adenovirus CPE can be confirmed by the use of IIF, EIA or RIA.

Adenoviruses 40/41 are fastidious and will only grow in a limited number of cell lines.

- Direct particle, antigen or genome detection
 - Electron microscopy on faecal specimens is useful in the diagnosis of adeno 40/41 gastroenteritis but is not routinely available. A membrane

Epidemiology (Table 2)

Table 2 Epidemiology

Clinical picture	Serotypes	Epidemiology
Respiratory disease		
■ URTI (coryza, pharyngitis, otitis media, tonsillitis)	1,2,3,5,7	Winter/spring
■ LRTI (croup, bronchiolitis, bronchitis, pneumonia)	3,7,4,21	Third most common cause of viral respiratory infection in children under the age of 4 years Transmitted via aerosols/direct contact
■ Acute respiratory disease in military recruits (ARD)	3,4,7,14,21	Outbreaks Risk factors include: military recruits from various cultures in an overcrowded environment, early in their training programme, strenuous exercise and exertion Transmission via air filters in barracks has occurred Ad14 has been associated with a particularly severe and potentially fatal form of respiratory tract illness
Ocular disease		
■ Pharyngoconjunctival fever (PCF)	3,4,7,11-17, 19-21, 29	Outbreaks due to inadequate chlorination of swimming pools Transmission via swimming or swallowing of water
■ Epidemic keratoconjunctivitis (ECC)	8,19,37	Also known as 'Shipyard's eye' of Pearl Harbor fame Transmitted via direct contact, fomites, tonometry, instruments and solutions used in ophthalmology
Infantile gastroenteritis	40,41,12,31	Second most common cause of GE in children under the age of 2 years Faecal-oral transmission
Haemorrhagic cystitis	11,34,35	Immunocompromised patients



- Experiments, using adenoviruses as viral **vectors** in gene therapy, vaccine research and cancer therapy are currently undertaken.
- Adenoviral vectors are investigated for their role in the treatment of cystic fibrosis (*CFTR* gene), muscle dystrophy (*dystrophin*), in anti-cancer treatment by altering expression of p53 and in prospective vaccines for HIV and rabies.

EIA is widely available and in use for the detection of antigens from adeno 40/41 from stool. The viral genome can be detected by molecular techniques including hybridisation techniques and PCR.

Indirect methods

- Serology – serological assays may yield false-negative results in immunocompromised patients and may only prove helpful in diagnosing infections retrospectively.

Only 20–50% of infected individuals mount specific IgM responses.

Prevention

No vaccine is currently available. Good infection control measures and adequate chlorination of swimming pools may prevent infections.

Treatment

Agents available for the treatment of adenoviral infections include ribavirin, cidofovir, gancyclovir and vidarabine. Immunotherapy, e.g. donor lymphocyte infusion and in vitro administration of cytotoxic T-cells may be considered in specific scenarios.

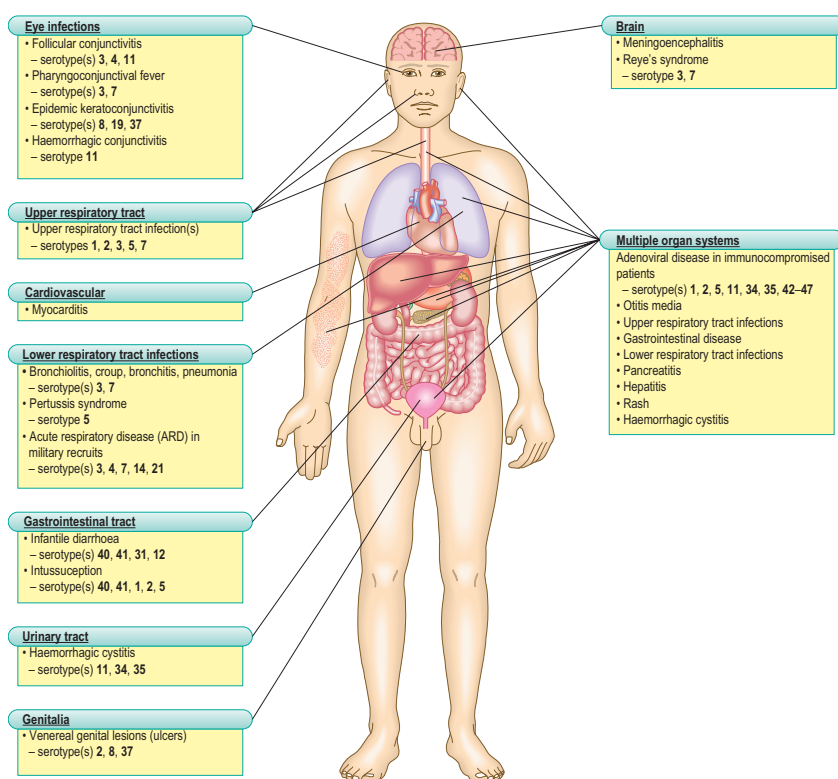


Fig. 4 Adenoviruses – clinical picture.