Epstein–Barr virus AND Parvovirus B19

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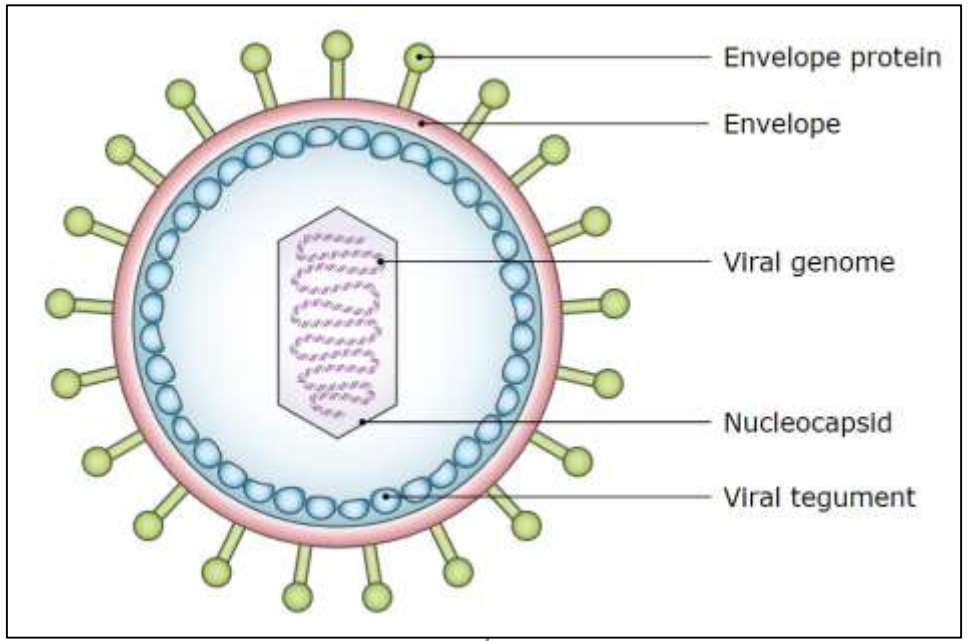
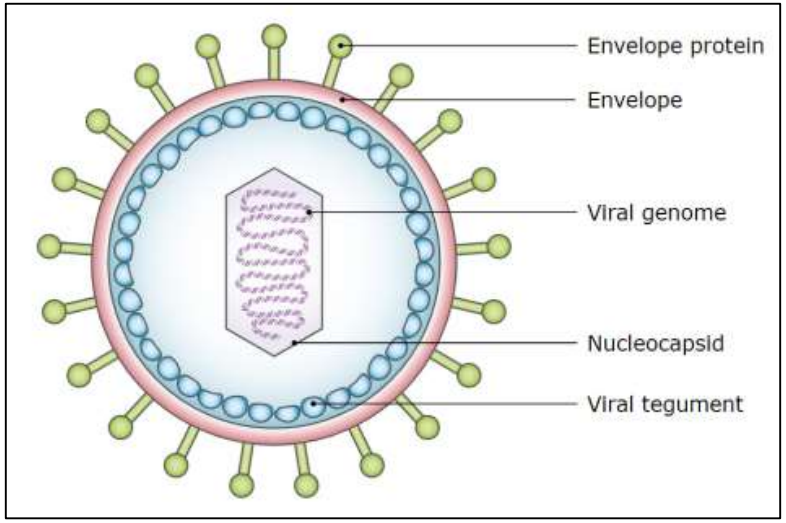
Epstein–Barr virus



EBV Structure



- Enveloped, double-stranded DNA virus
- Genome: Linear dsDNA
- Icosahedral nucleocapsid Four significant structural components:
  - Core containing viral DNA
  - Nucleocapsid
  - Tegument (protein layer between capsid and envelope)
  - Envelope with embedded glycoproteins

Clinical syndromes associated with EBV infection

- Infectious mononucleosis.
- Burkitt lymphoma.
- B-cell lymphomas
- Chronic EBV infection.
- Lymphoproliferative disorder in immunocompromised.
- Nasopharyngeal carcinoma.
- Hairy leukoplakia

Diseases Caused by EBV

- Acute infectious mononucleosis
- Oral hairy leukoplakia
- Lymphoproliferative disorders and malignancies
  - Burkitt lymphoma
  - Hodgkin lymphoma
  - Post-transplant lymphoproliferative disease
  - Nasopharyngeal carcinoma

EBV Epidemiology

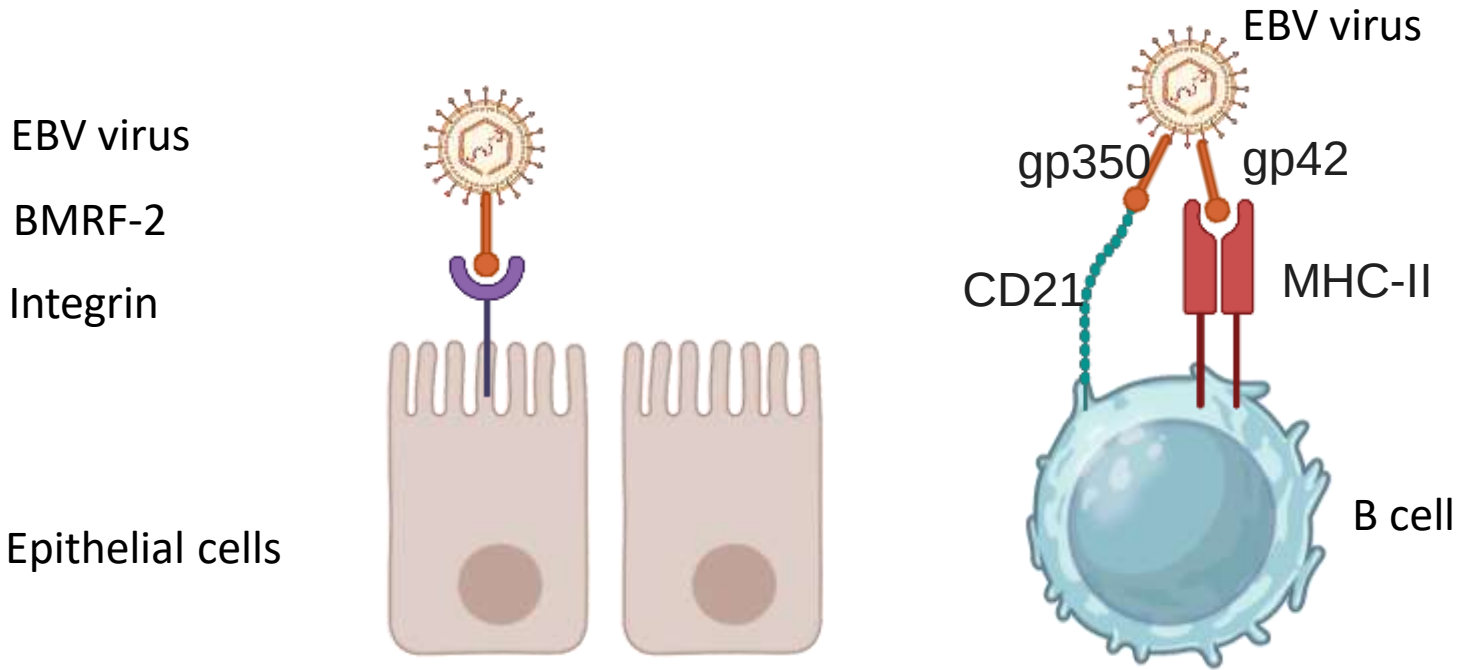
- Ubiquitous worldwide distribution (>90% of adults seropositive)
- Primary infection typically occurs:
  - During childhood in developing countries (usually asymptomatic)
  - During adolescence or young adulthood in developed countries (~50% develop infectious mononucleosis)
- Lifelong persistence following primary infection

Transmission

- **Transmission:**
  - Primarily through saliva ("kissing disease")
  - Less commonly through blood transfusions, organ transplantation
  - Possible vertical transmission (rare)

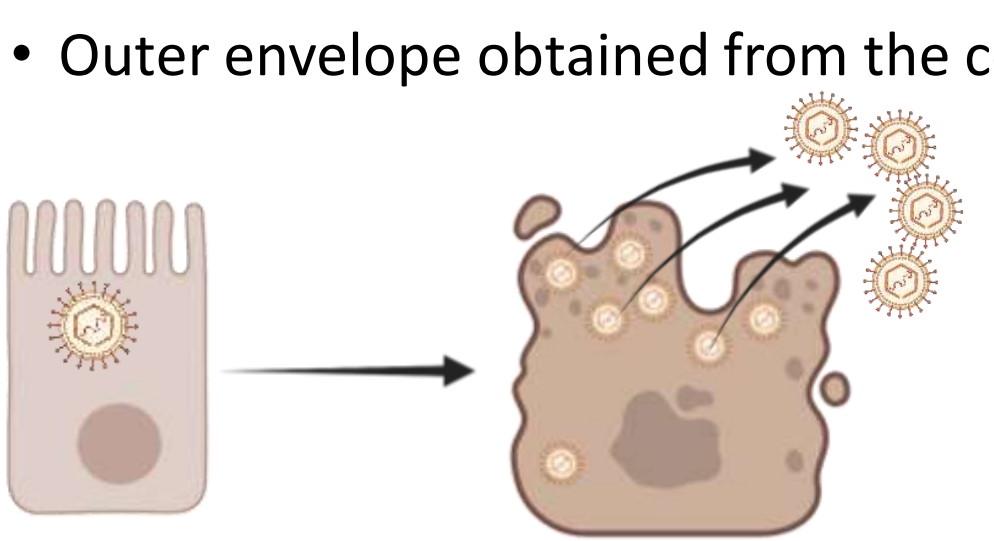
Viral life cycle

- **Cell entry:**
  - EBV binds to receptors on the cell surface (particularly CD21 on B cells)
  - Fusion with the cell membrane → nucleocapsid released into the cytoplasm
  - Transported to the cell's nucleus → can enter lytic replication or latency

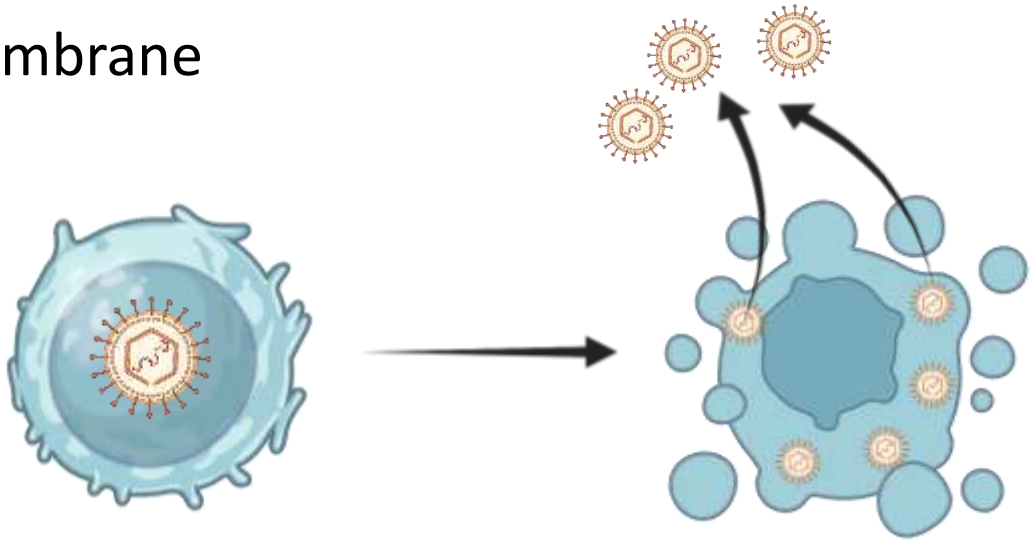


Viral replication cycle (cont.)

- **Lytic replication (or Productive replication):**
  - After latency or entry into nucleus → DNA becomes linear
  - Replication with viral DNA polymerase → assembly → bud out from the nuclear membrane
  - Outer envelope obtained from the cell membrane



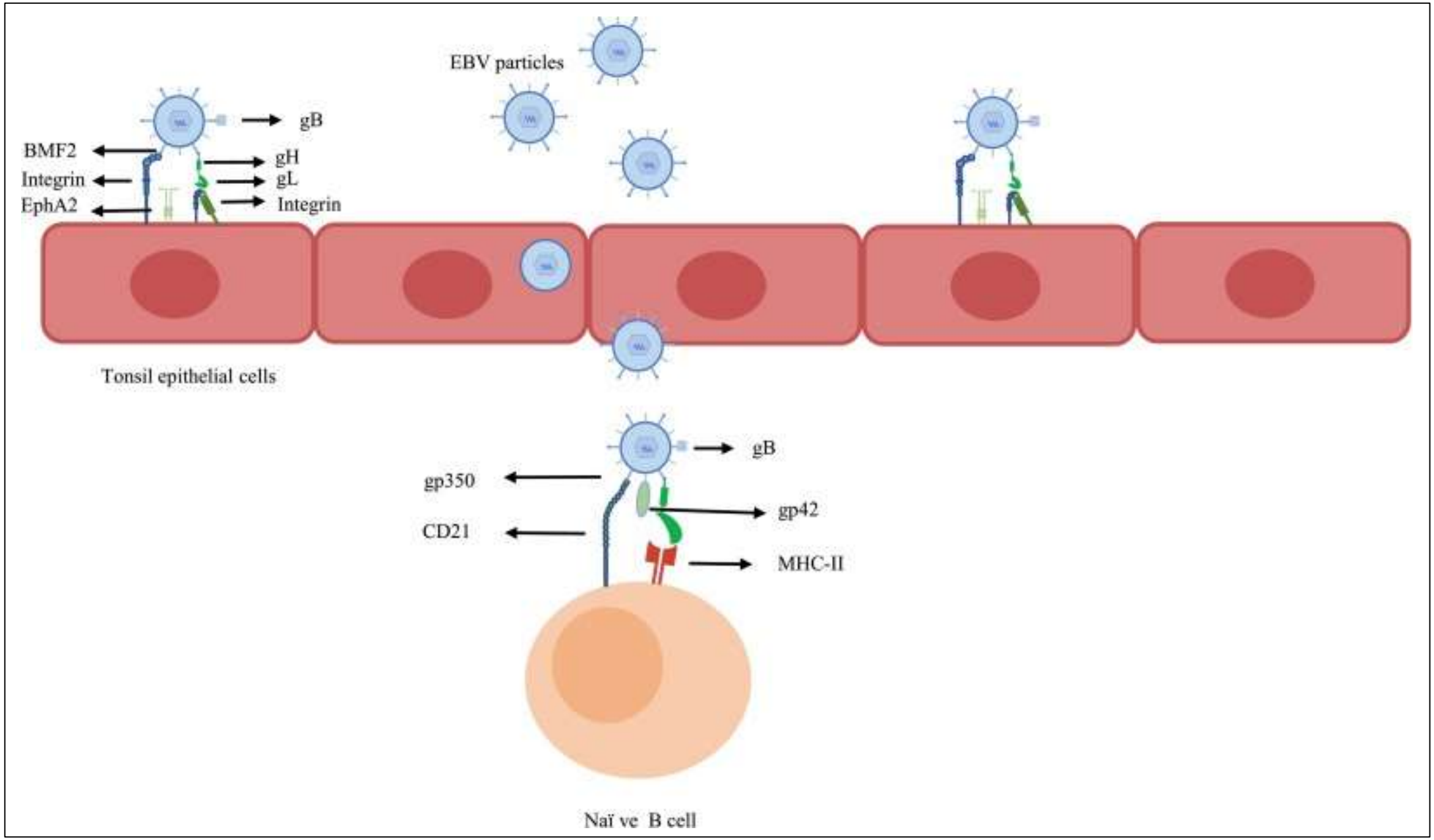
Epithelial cells



B cell

Viral replication cycle

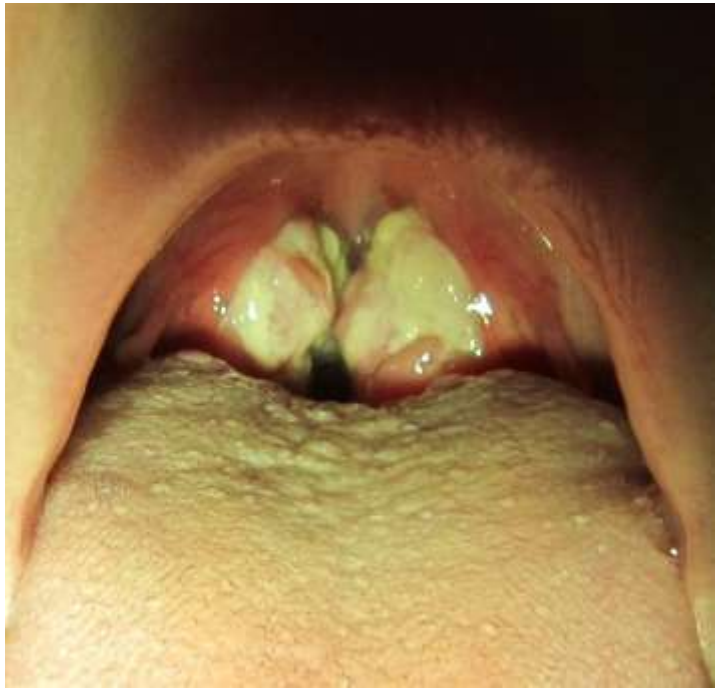
- **Latency:**
  - After entry into nucleus → DNA becomes circular (episome)
  - Only a portion of genes are expressed
  - Can reactivate → lytic replication (trigger is unclear)
  - Usually with b cells, but could occur on epithelial cells also.


EBV particles
gB
BMF2
gH
Integrin
gL
EphA2
Integrin
Tonsil epithelial cells
gB
gp350
gp42
CD21
MHC-II
Naï ve B cell

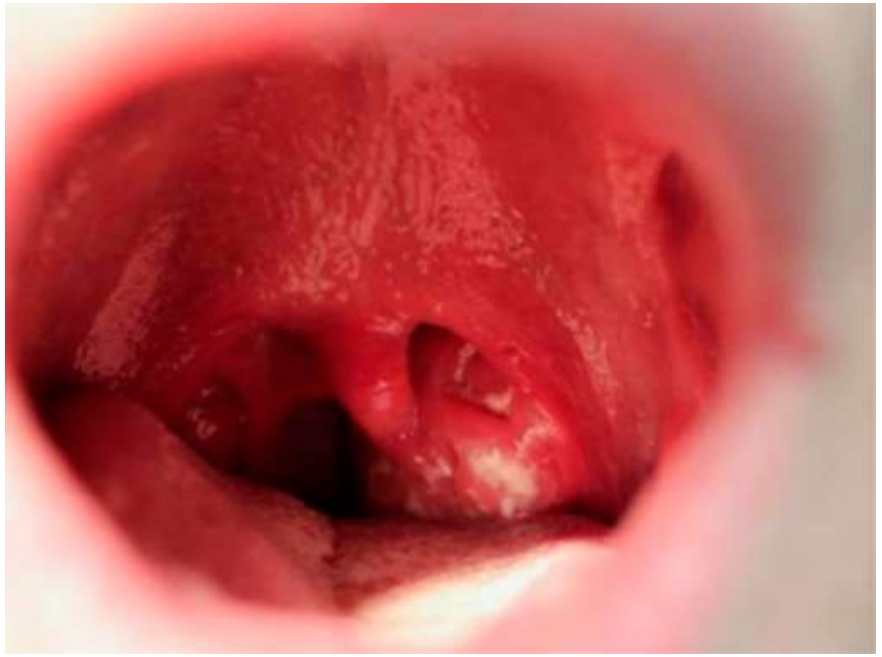
Acute infectious mononucleosis

- **Presentation:**
  - Fever
  - Tonsillitis (swollen and erythematous tonsils that may be covered in exudate)
  - Cervical lymphadenopathy (most commonly the posterior cervical and posterior auricular chains)
  - Headache
  - General malaise and fatigue
  - Petechiae present at the junction between the hard and soft palates
  - Hepatosplenomegaly
  - Maculopapular rash (similar to measles, present in approximately 5% of cases)

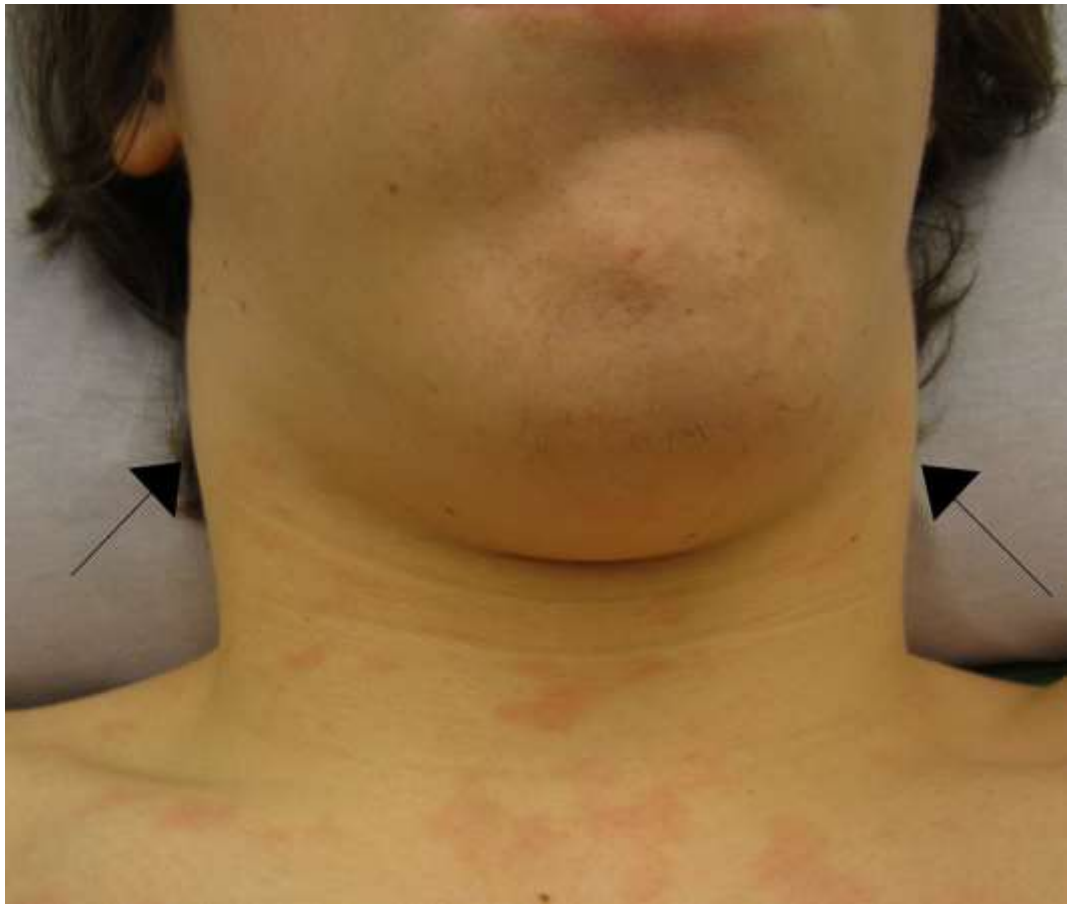
Acute infectious mononucleosis



Exudative tonsillopharyngitis
Pharynx and tonsils in a patient with infectious mononucleosis
The tonsils are massively hypertrophied, touching at the midline (known as “kissing tonsils”), and covered with gray-white exudate. The visible parts of the pharynx are erythematous.



Infectious mononucleosis: pharyngitis demonstrating exudative tonsillitis and an enlarged uvula in a 19-year-old undergraduate university student 5 days after onset of infectious mononucleosis



Lymphadenopathy in a patient with mononucleosis

Bilaterally enlarged cervical lymph nodes (black arrows) and submandibular lymph nodes are seen in the neck region of a patient with infectious mononucleosis.

Additionally, there is a pale, macular rash on the neck and upper chest. A rash seen in infectious mononucleosis may be caused by the infection itself but is more commonly due to antibiotic use.

Infectious mononucleosis

Etiology
Pathogen: Predominantly Epstein-Barr virus (EBV)
Transmission: mainly via saliva (hence the common name "kissing disease")

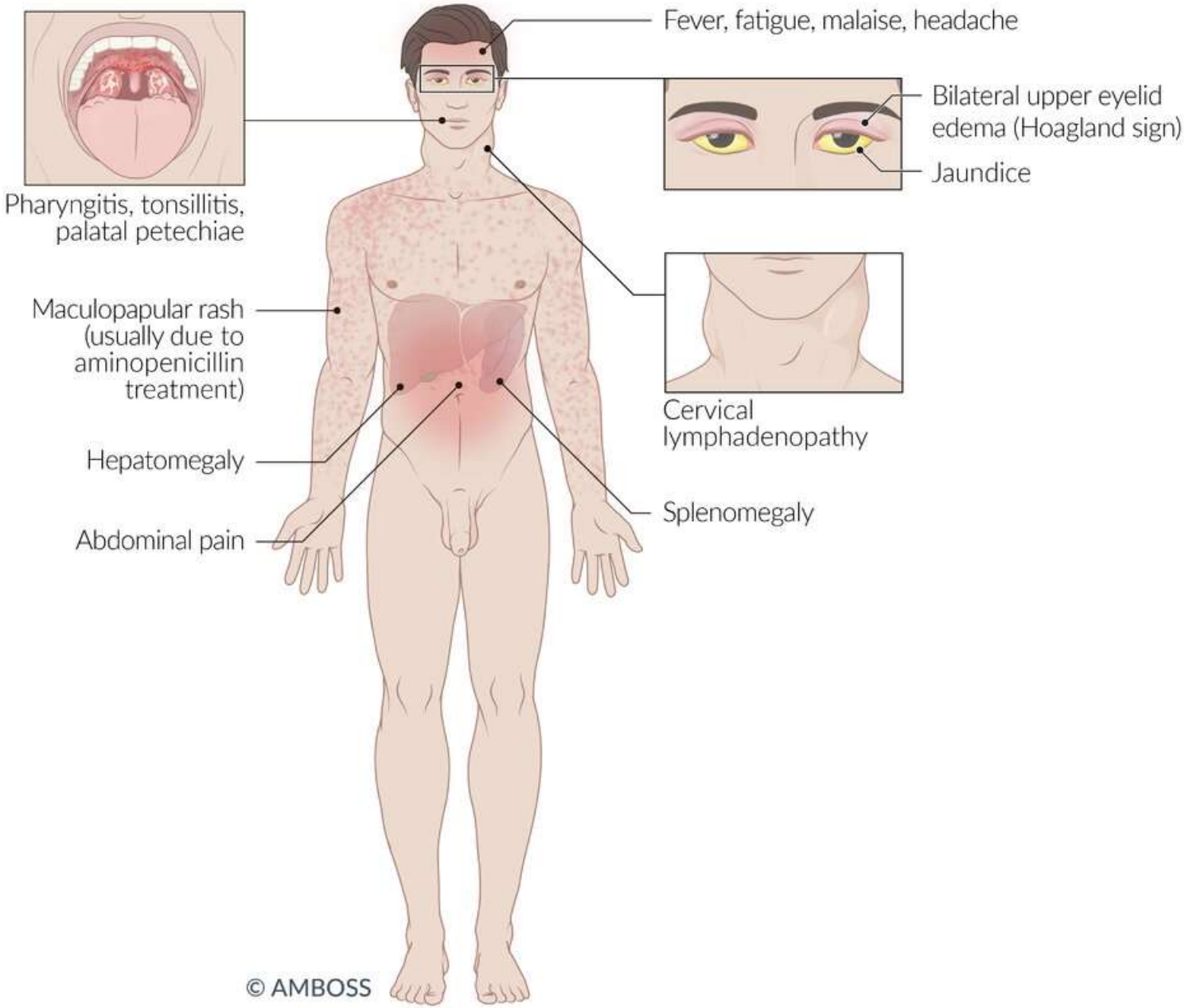
Epidemiology
Incidence (US): 5:1000 population/year
Peak age: 15–24 years
Prevalence (worldwide): > 90% adult population EBV-antibody positive

Clinical course
IIncubation period: ~ 6 weeks
Symptoms usually last 2–4 weeks
Often asymptomatic in young children

Diagnosis
EBV serology, monospot test, CBC with differential

Treatment
Mainly symptomatic
Avoid strenuous physical activity for 3–4 weeks due to risk of splenic rupture

Complications
Upper airway obstruction
Splenic rupture
Wide range of rare complications in other organ systems (higher risk in immunocompromised individuals)

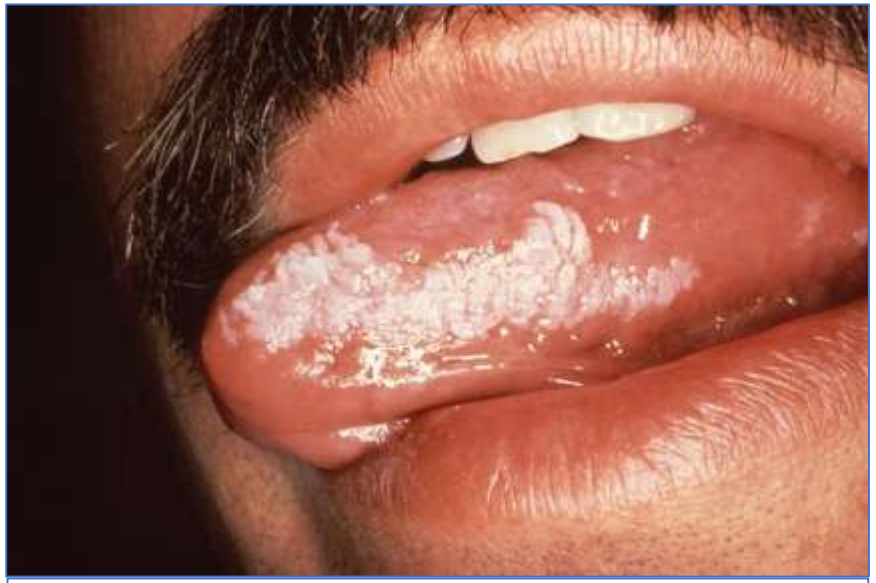


Acute infectious mononucleosis (cont.)

- **Management:**
  - Supportive
  - No available antiviral therapy

Oral hairy leukoplakia

- Oral hairy leukoplakia is caused by the reactivation of latent EBV and occurs mostly in patients who are HIV positive.
- **Clinical presentation:**
  - Not premalignant
  - White patches on the tongue
  - “Hairy” appearance (due to hyperkeratosis and epithelial hyperplasia)
  - Does not scrape off



White, hairy patch on a patient's tongue due to oral hairy leukoplakia

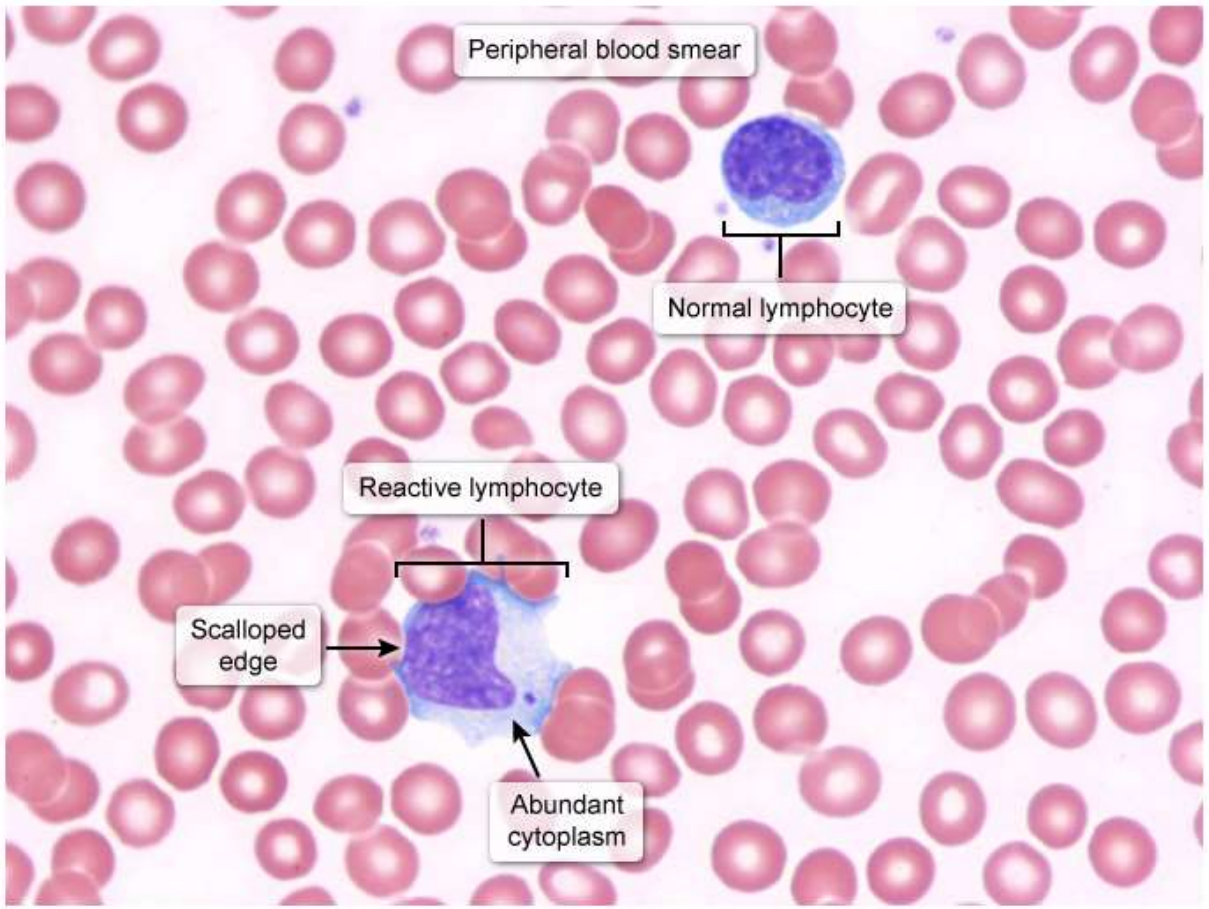
Oral hairy leukoplakia (cont.)

- **Management:**
  - Treatment is not required.
  - Antiretroviral therapy for HIV patients

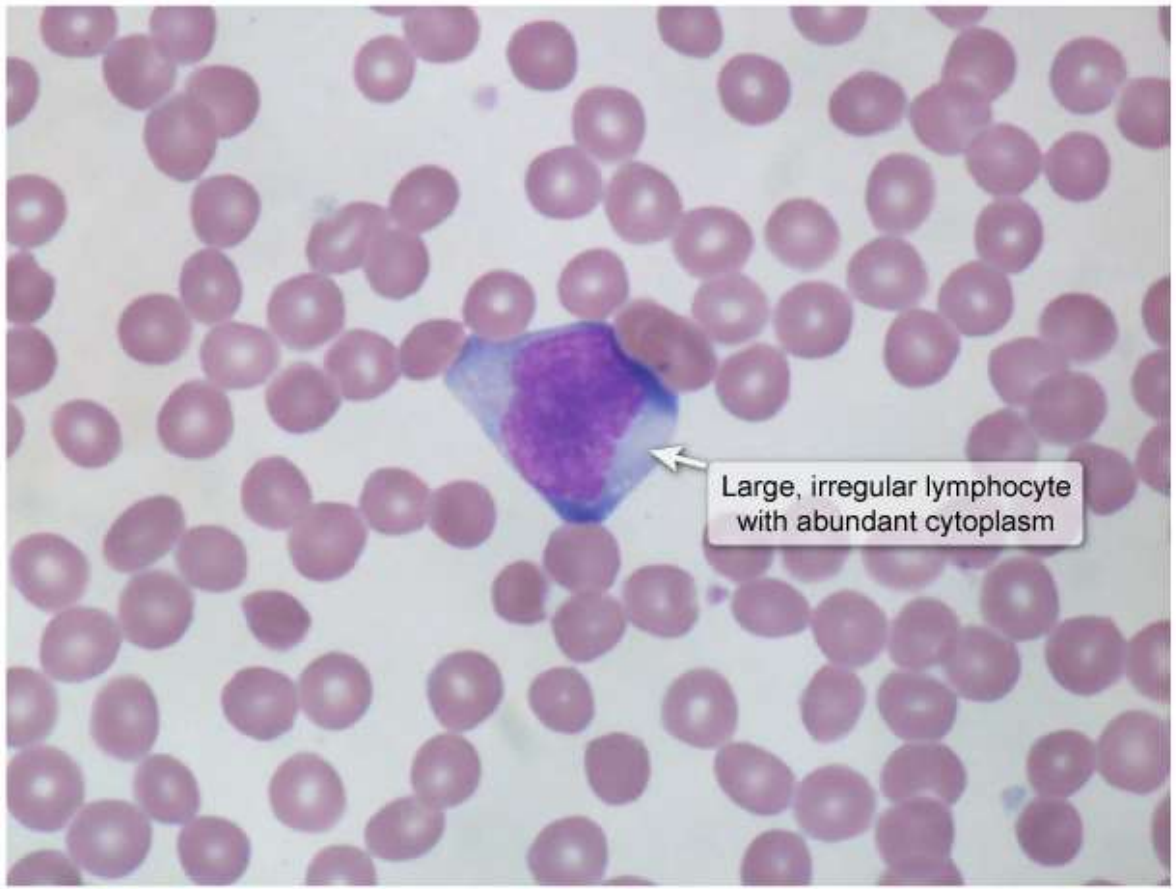
EBV - diagnosis

- EBV is suspected when patients having
  - Fever
  - Pharyngitis
  - Lymphadenopathy
- CBC with differential
  - Absolute lymphocyte count > 4 x 10^9/L
  - > 50% lymphocytes
  - > 10% atypical lymphocytes
- **Monospot (heterophile antibody) test**: a latex agglutination rapid test that uses red blood cells from horses to detect heterophile antibodies against EBV
- PCR (Most specific)

Reactive lymphocytes

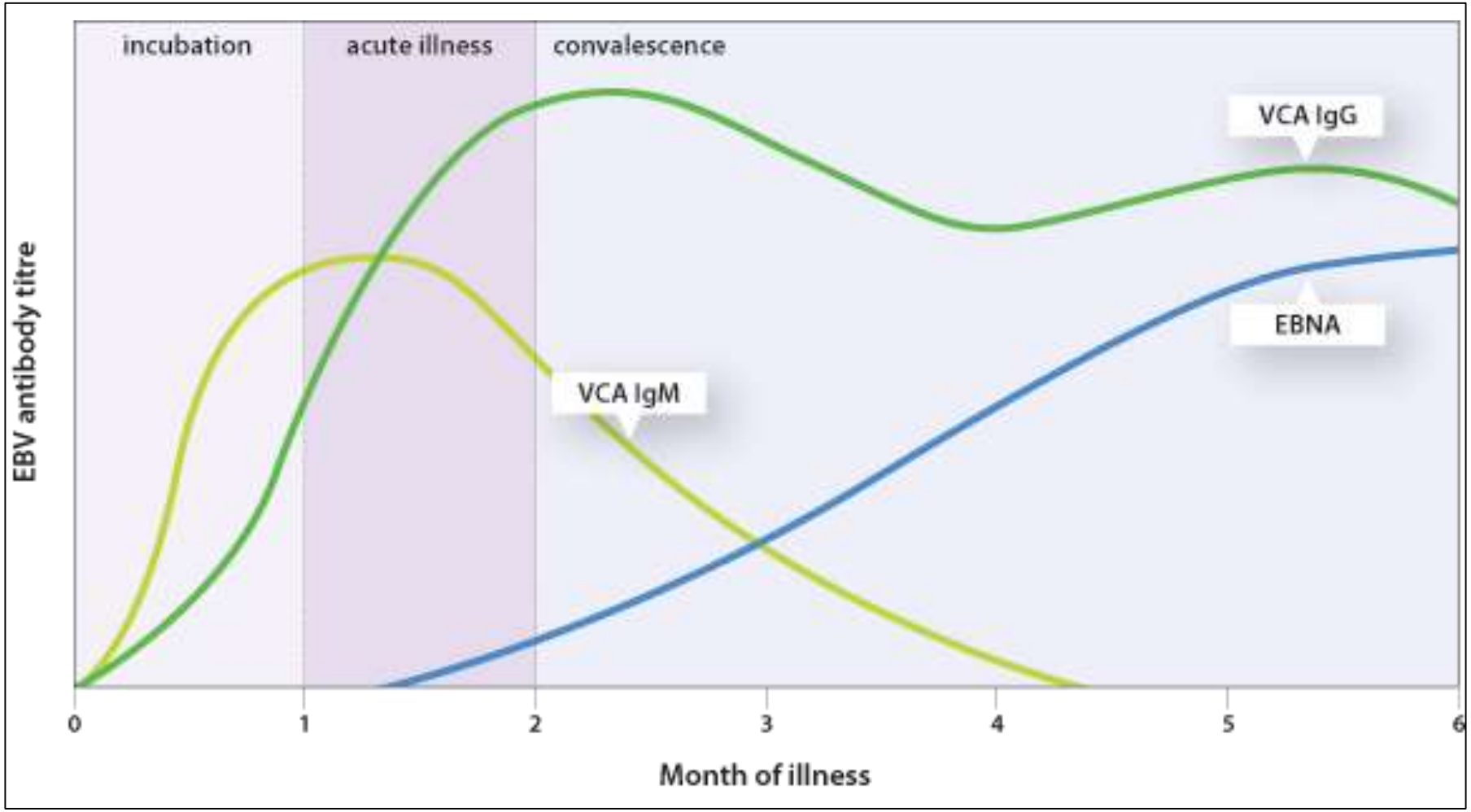


Atypical CD8+ T lymphocyte



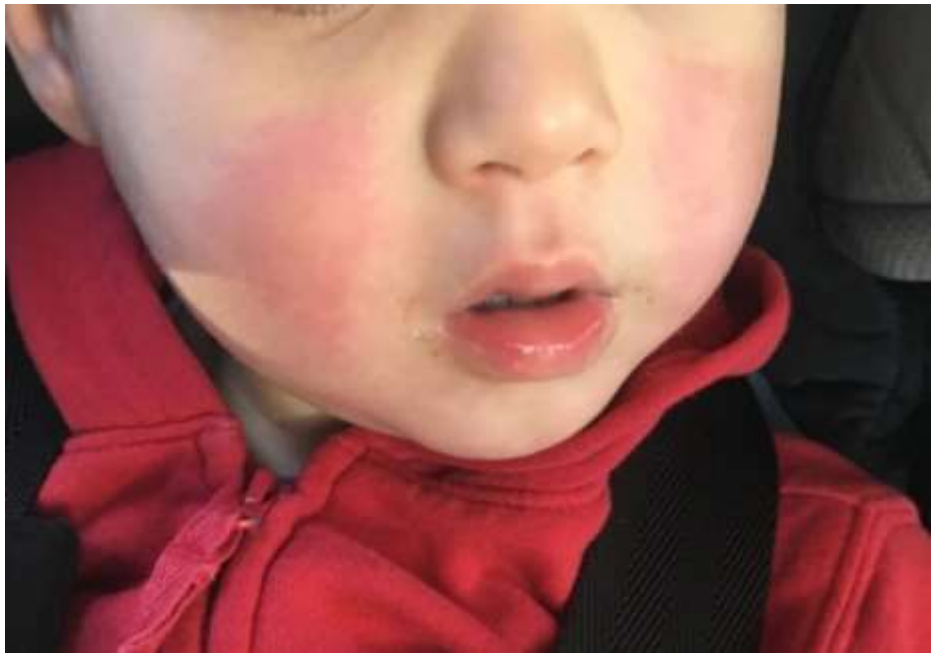
EBV – diagnosis (cont.)

- EBV serology is the most reliable laboratory study
- Antiviral capsid antigen antibodies (anti-VCA) for EBV
  - Anti-VCA IgM alone is sufficient to diagnose acute infection.
  - Anti-VCA IgG titers peak 2 weeks after symptom onset and may persist for life.
- EBV nuclear antigen (EBNA) antibodies are detectable ≥ 6 weeks after symptom onset and may persist for life.



Interpretation of VCA serology for EBV			
	anti-VCA IgM	**anti-VCA IgG**	**anti-EBNA IgG**
Acute infection (0–6 weeks)	↑	↑ (titers peak at 2 weeks)	Undetectable
Past infection (≥ 6 weeks)	Undetectable	↑	↑

Parvovirus B19



Parvovirus B19 - Structure

- Human parvovirus B19 (the smallest of the DNA viruses infecting humans)
  - Family: Parvoviridae
  - Single-stranded DNA virus (linear)
  - Nonenveloped
- **Route of transmission**
  - Main route: aerosol
  - Other routes
    - Hematogenous transmission
    - Transplacental transmission: In seronegative pregnant women, transmission to the unborn fetus may occur (in up to 30% of cases).

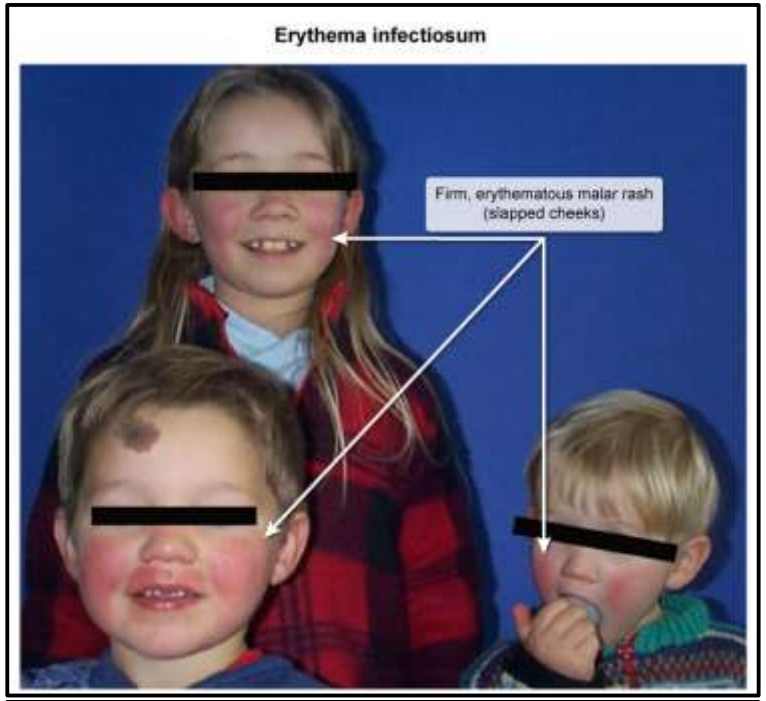
Pathogenesis

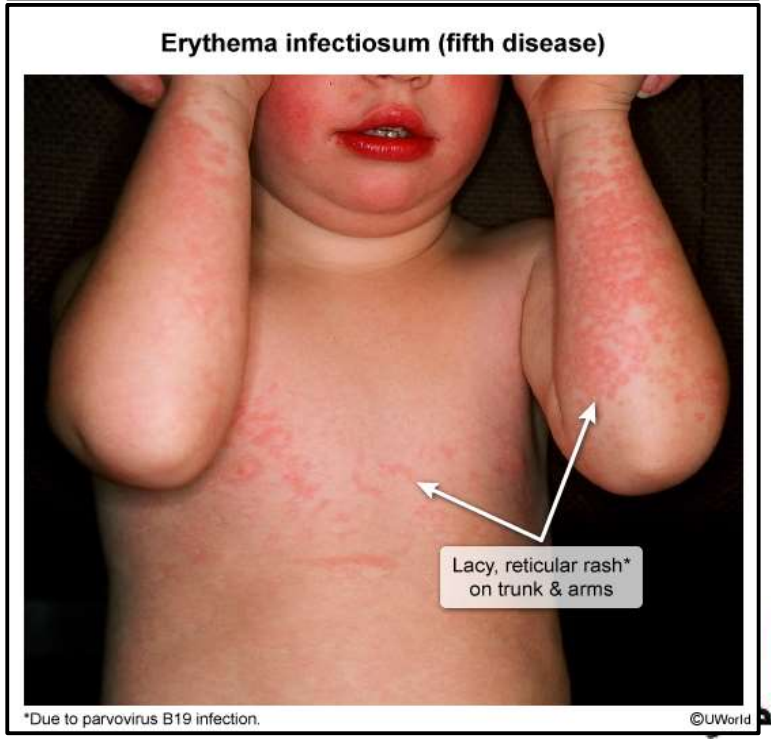
- Parvovirus B19 binds to the P antigen (globoside) on **erythroid progenitor cells** → cellular invasion → viral DNA enters the nucleus of erythroid cells → viral DNA replication → cytotoxicity → clinical manifestations + transient cessation of erythropoiesis
- Parvovirus B19 can also bind to and infect endothelial cells via the P antigen, potentially causing cardiovascular complications.

Clinical Manifestations

Individuals may be asymptomatic or have any of the following presentations:

1. **Erythema infectiosum (or fifth disease):**
   In children, it produces rashes on the face with characteristic slapped cheek appearance (diffuse redness of the face with perioral sparing)
   Adult women present with symmetrical polyarthropathy which usually involves the hand joints and knee





Clinical Manifestations

2. **Transient aplastic crisis:** It can occur in infected patients with preexisting hematologic disease (eg, sickle cell anemia, hereditary spherocytosis), resulting in severe acute anemia
3. **Non-immune hydrops fetalis** can occur in fetus, which results in fatal anemia and fetal death. Transplacental transmission occurs in 30% of cases and maximum risk is in the second trimester
4. **Mild respiratory symptoms**
5. **Parvovirus B19-associated arthritis**

Diagnosis

- Erythema infectiosum and parvovirus B19-associated arthritis are diagnosed clinically.
- Confirmatory studies for parvovirus B19
  - Immunocompetent individuals: IgM and IgG antibodies
    - IgM: usually detectable when the rash appears; remains positive for 2–3 months
    - IgG: positive after approx. 2 days; remains positive for life
  - Immunocompromised individuals: NAAT

TREATMENT

- No antiviral drug is available
- Symptomatic treatment is given
- Immunoglobulins containing neutralizing antibodies to human parvovirus are available commercially.

Thank You