Department of Infectious Diseases

Immunization of adults

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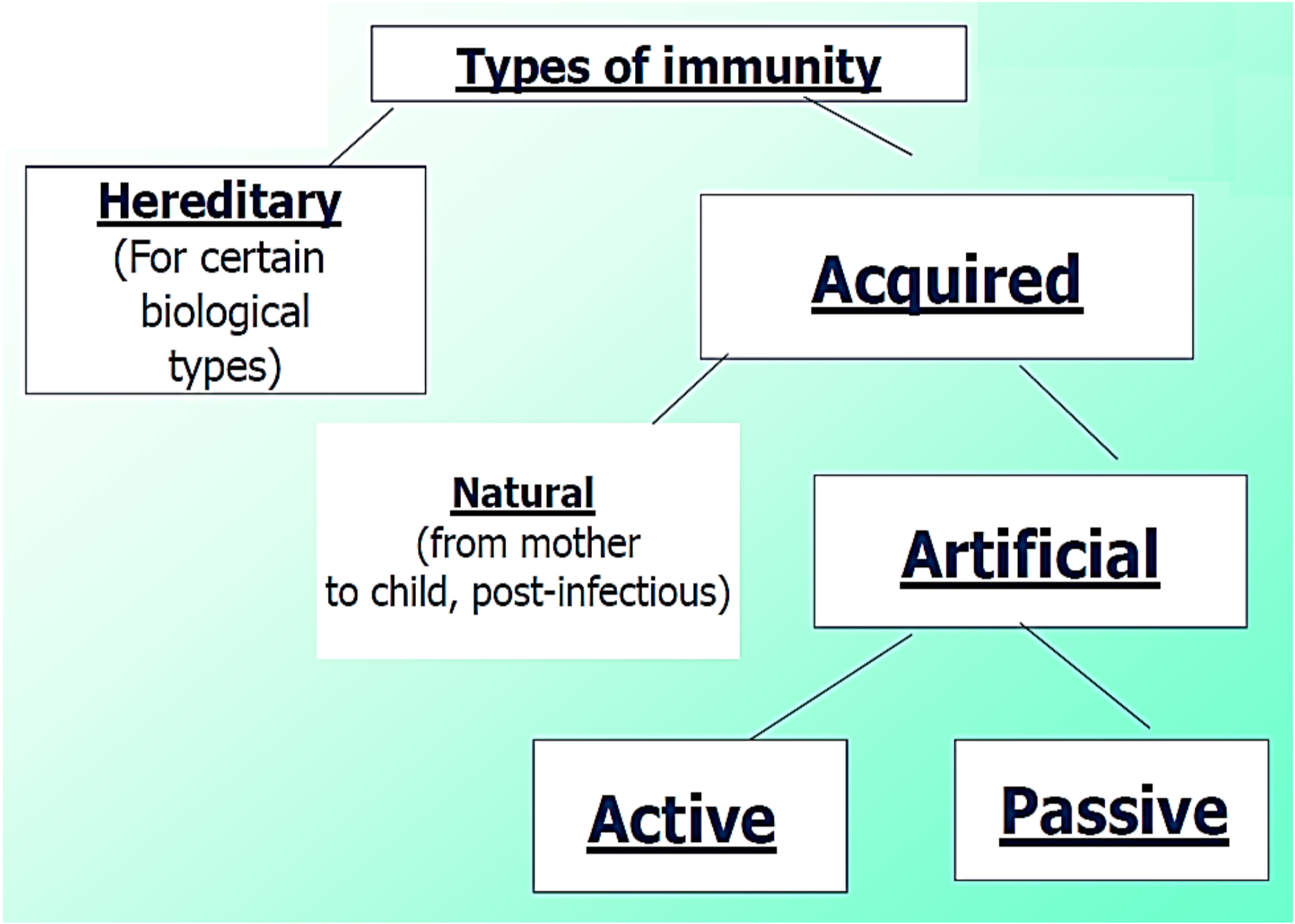
Types of immunity
Hereditary
(For certain biological types)
Acquired
Natural
(from mother to child, post-infectious)
Artificial
Active
Passive

Prevention of infections

Depends on three concepts:

- Elimination of the source of infection;
- Prevention of transmission of infective agents;
- **Protection of susceptible persons by active or passive immunization.**

Immunization Basics

THE GOAL: to induce immunity (i.e. state of resistance to an infection) in an immunized person for a certain period of time (several weeks – several decades).

INDICATIONS:

- **Schedule vaccination by age** (routine, obligatory, mass);
- **Prophylactic vaccination due to professional activity**;
- **Prophylactic vaccination due to epidemic indications:**
  - ✓the danger of infection spreading (e.g. influenza);
  - ✓the danger of high mortality (e.g. tetanus).

Immunization Basics

Types of Immunizations:

- **ACTIVE** – exposure to antigen with the host generating protective immunity.

  Goal: provide long lasting immunity against future exposures.

- **PASSIVE** – administration of humoral and/or cellular factors that provide immunity for the host.

  Goal: provide temporary immediate protection against an imminent or ongoing exposure/threat.

Passive Immunization

NATURAL

- transfer of antibody from mother to infant in placental circulation (IgG) or colostrum (IgA)

ARTIFICIAL

- antibody therapy (serum therapy) via administration of:
  - ✓ human immunoglobulins
  - ✓ animal sera
  - ✓ monoclonal antibodies

Artificial Passive Immunization

IMMEDIATE ACTION

SHORT-LIVED IMMUNITY

(determined by the half-life of IG: ≈ 3 wks. for IgG and few days for the other isotypes)

- **prophylactic purposes:** to protect immunodeficient patients or to prevent disease development after exposure of an individual to a particular pathogen (ex. accidental injury by the HBV-contaminated needle or bite by the rabid animal);
- **therapy purposes:** to reduce the clinical symptoms of the disease and often represents the life-saving therapeutic method (ex. diphtheria or botulism).

Tetanus: Krok 2

A farmer hurt his right foot during working in a field and came to the emergency station. **He does not remember when he got last vaccination** and he has never served in the army. Examination of his right foot revealed a **contaminated wound up to 5-6 cm long with uneven edges**. The further treatment tactics will be:

- To make an injection of tetanus anatoxin
- To make an injection of antitetanus serum
- Surgical d-bridement only
- To administer an antibiotic
- To make an injection of tetanus anatoxin and antitetanus serum

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- To make an injection of antitetanus serum
- Surgical d-bridement only
- To administer an antibiotic
- To make an injection of tetanus anatoxin and **ANTITETANUS SERUM**

Tetanus: PEP

Vaccination status	Clean, minor wounds	All other wounds
Unknown or < 3 doses of TT containing vaccine	**Tdap** and recommend catch-up vaccination	**Tdap** and recommend catch-up vaccination **Tetanus Ig**

Active Immunization

Vaccination is a common strategy to control, eliminate, eradicate, or contain disease (i.e., mass immunization strategy).

"Herd" immunity

the vaccination of a significant portion of a population provides a measure of protection for individuals who have not developed immunity.

Diphtheria: Krok 2

In an inhabited locality, there is an increase of diphtheria during the last 3 years with separate outbursts in families.

What measure can effectively influence the epidemic process of diphtheria and **reduce the morbidity rate** to single cases?

- Hospitalization of patients
- Detection of carriers
- Early diagnostics
- Immunization of the population
- Disinfection in disease focus

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Diphtheria

- **Disease is preventable through vaccination**.
- **NB! Adherence to the recommended schedule of decennial Td boosters in adults is important to prevent sporadic cases and to maintain population immunity.**
- Respiratory diphtheria is characterized by a grayish colored, adherent membrane in the pharynx, palate, or nasal mucosa that can obstruct the airway.
- Toxin-mediated cardiac and neurologic systemic complications can occur.

Diphtheria: Krok 2

A woman came to a doctor with complaints of increased body temperature up to **37.8°C and moderately sore throat** for the last 3 days.
Objectively: mandibular lymph nodes are enlarged up to 3 cm. **Palatine tonsils** are hypertrophied, **with gray coating that spreads to the uvula and anterior pillars of the fauces**. What is the most likely diagnosis?

- Infectious mononucleosis
- Pseudomembranous (Vincent's) tonsillitis
- Oropharyngeal diphtheria
- Agranulocytosis
- Oropharyngeal candidiasis

Available vaccines

Vaccine Type	Examples
Inactivated bacteria	typhoid & paratyphoid, pertussis, cholera, plague
Attenuated bacteria	Bacille Calmette-Guénn (BCG), typhoid
Surface molecules	influenza, hepatitis B surface antigen, *S. pneumonia & N. meningitidis* capsular polysaccharides, *H. influenzae* type b capsular oligosaccharides
Toxoids	diphtheria, tetanus, pertussis
Inactivated virus	Salk vaccine for polio, rabies
Attenuated virus	Sabin oral polio vaccine, measles, mumps, rubella, yellow fever, varicella, rotovirus
Recombinant viral proteins	hepatitis A & B, HPV

Killed vs Attenuated

Killed vaccine	Attenuated vaccine
• Don’t stimulate local immunity	• Stimulate both humoral and local and immunity
• Short lasting	• Long lasting
• Don’t stimulate cytotoxic T-cell response	• Cell mediated
• Safe (can be given to pregnant and immunocompromised)	• Unsafe (not given to pregnant and immunocompromised)
• It is heat stable	• Heat unstable

Recommended immunization schedule for adults by age group, US, 2018

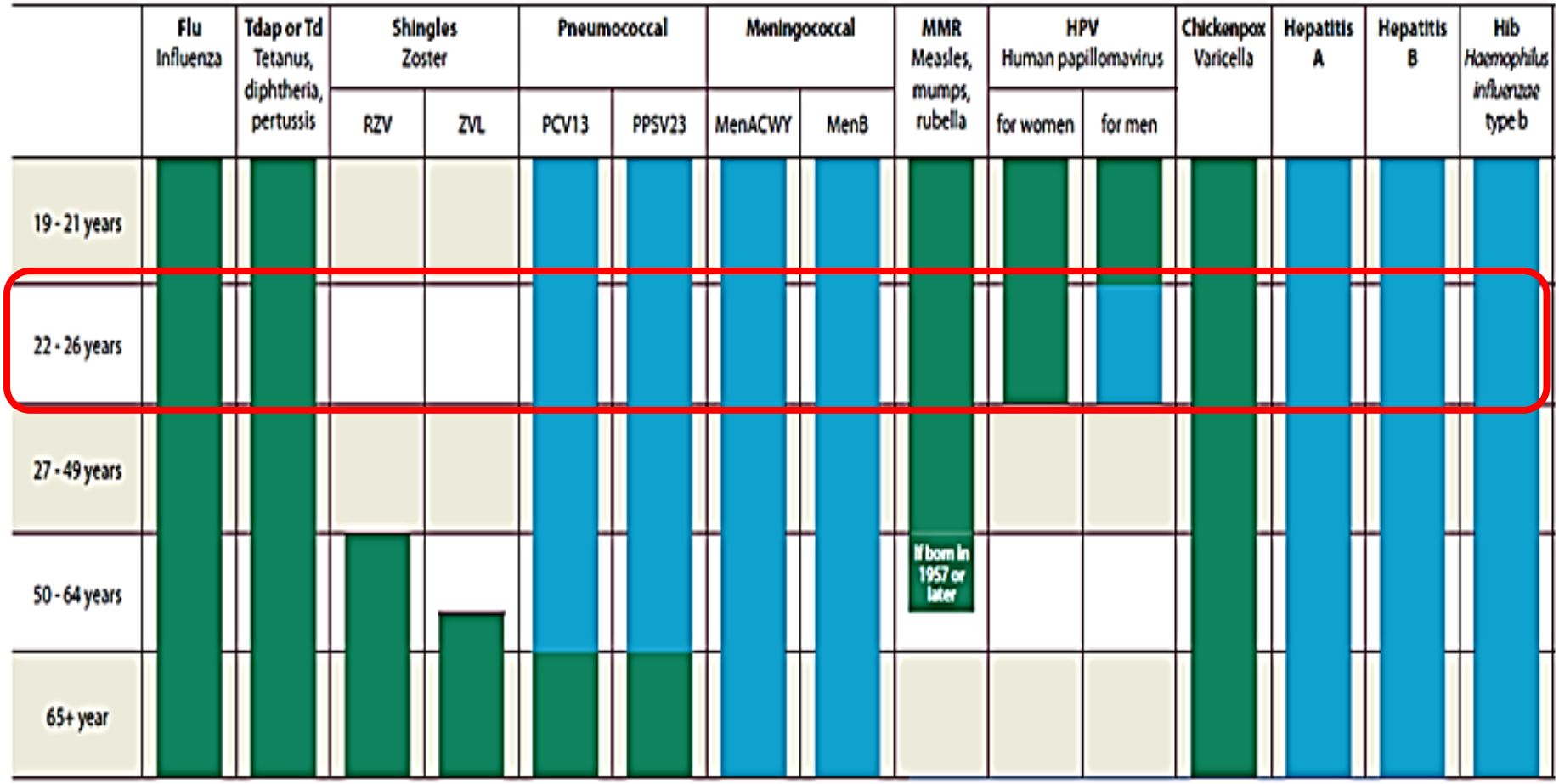
Vaccine	19–21 years	22–26 years	27–49 years	50–64 years	≥65 years
Influenza[1]	1 dose annually				
Tdap[2] or Td[2]	1 dose Tdap, then Td booster every 10 yrs				
MMR[3]	1 or 2 doses depending on indication (if born in 1957 or later)				
VAR[4]	2 doses				
RZV[5] (preferred)				2 doses RZV (preferred)	
or				or	
ZVL[5]					1 dose ZVL
HPV–Female[6]	2 or 3 doses depending on age at series initiation				
HPV–Male[6]	2 or 3 doses depending on age at series initiation				

Recommended for adults who meet the age requirement, lack documentation of vaccination, or lack evidence of past infection

Recommended for adults with other indications

No recommendation

Recommended immunization schedule for adults by age group, US, 2018



Recommended For You: This vaccine is recommended for you ***unless*** your health care professional tells you that you do not need it or should not get it.

May Be Recommended For You: This vaccine is recommended for you if you have certain risk factors due to your health condition. Talk to your health care professional to see if you need this vaccine.

Recommended immunization schedule for adults by age group, US, 2018

Vaccine	19–21 years	22–26 years	27–49 years	50–64 years	≥65 years
PCV13[7]	1 dose				
PPSV23[7]	1 or 2 doses depending on indication				1 dose
HepA[8]	2 or 3 doses depending on vaccine				
HepB[9]	3 doses				
MenACWY[10]	1 or 2 doses depending on indication, then booster every 5 yrs if risk remains				
MenB[10]	2 or 3 doses depending on vaccine				
Hib[11]	1 or 3 doses depending on indication				

Recommended for adults who meet the age requirement, lack documentation of vaccination, or lack evidence of past infection

Recommended for adults with other indications

No recommendation

Immunization schedule for adults by medical condition and other indications

Vaccine	Pregnancy[1-6]	Immuno-compromised (excluding HIV infection)[3-7,11]	HIV infection CD4+ count (cells/μL)[3-7,9-10]		Asplenia, complement deficiencies[7,10,11]	End-stage renal disease, on hemodialysis[7,9]	Heart or lung disease, alcoholism[7]	Chronic liver disease[7-9]	Diabetes[7,9]	Health care personnel[3,4,9]	Men who have sex with men[6,8,9]
			<200	≥200							
Influenza[1]	1 dose annually										
Tdap[2] or Td[2]	1 dose Tdap each pregnancy	1 dose Tdap, then Td booster every 10 yrs									
MMR[3]	contraindicated			1 or 2 doses depending on indication							
VAR[4]	contraindicated			2 doses							
RZV[5] (preferred)					2 doses RZV at age ≥50 yrs (preferred)						
or					or						
ZVL[5]	contraindicated				1 dose ZVL at age ≥60 yrs						
HPV-Female[6]		3 doses through age 26 yrs			2 or 3 doses through age 26 yrs						
HPV-Male[6]		3 doses through age 26 yrs			2 or 3 doses through age 21 yrs						2 or 3 doses through age 26 yrs

Immunization schedule for adults by medical condition and other indications

Vaccine	Pregnancy[1,6]	Immuno-compromised (excluding HIV infection)[3,7,11]	HIV infection CD4+ count (cells/µL)[3,7,9,10]		Asplenia, complement deficiencies[7,10,11]	End-stage renal disease, on hemodialysis[7,9]	Heart or lung disease, alcoholism[7]	Chronic liver disease[7,9]	Diabetes[7,9]	Health care personnel[3,4,9]	Men who have sex with men[6,8,9]
			<200	≥200							
PCV13[7]		1 dose									
PPSV23[7]		1, 2, or 3 doses depending on indication									
HepA[8]		2 or 3 doses depending on vaccine									
HepB[9]		3 doses									
MenACWY[10]		1 or 2 doses depending on indication , then booster every 5 yrs if risk remains									
MenB[10]		2 or 3 doses depending on vaccine									
Hib[11]		3 doses HSCT recipients only			1 dose						

Special populations that need additional considerations

- **Pregnant women** should receive:
  - the tetanus, diphtheria, and acellular pertussis vaccine (Tdap) during pregnancy;
  - the influenza vaccine during or before pregnancy.

Immunization schedule for adults by medical condition and other indications

Vaccine	Pregnancy[1-6]	Immuno-compromised (excluding HIV infection)[3-7,11]	HIV infection CD4+ count (cells/μL)[3-7,9-10]		Asplenia, complement deficiencies[7,10,11]
			<200	≥200	
Influenza[1]					
Tdap[2] or Td[2]	1 dose Tdap each pregnancy	Td booster every 10 yrs			
MMR[3]	contraindicated				
VAR[4]	contraindicated				
RZV[5] (preferred)					
or					
ZVL[5]	contraindicated				
HPV–Female[6]		3 doses through age 26 yrs			
HPV–Male[6]		3 doses through age 26 yrs			

Special populations that need additional considerations

- **Immunocompromising conditions** (HIV infection, corticosteroid therapy, cancer chemotherapy etc.):
  - ✓generally avoid live vaccines
  - ✓inactivated vaccines (e.g., pneumococcal vaccines) are generally acceptable.
- **Asplenia** (congenital or acquired asplenia, splenic dysfunction, sickle cell disease and other hemoglobinopathies, and splenectomy):
  - ✓specific vaccination recommendations because of increased risk for infection by encapsulated bacteria.

Immunization schedule for adults by medical condition and other indications

Vaccine	Pregnancy[1,6]	Immuno-compromised (excluding HIV infection)[3,7,11]	HIV infection CD4+ count (cells/μL)[3,7,9,10]		Asplenia, complement deficiencies[7,10,11]
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PCV13[7]					
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Tdap[2] or Td[2]	1 dose Tdap, then Td booster every 10 yrs			
MMR[3]	1 or 2 doses depending on indication			
VAR[4]	2 doses			
RZV[5] (preferred)	2 doses RZV at age ≥50 yrs (preferred)			
or	or			
ZVL[5]	1 dose ZVL at age ≥60 yrs			
HPV–Female[6]	2 or 3 doses through age 26 yrs			
HPV–Male[6]	2 or 3 doses through age 21 yrs			

Immunization schedule for adults by medical condition and other indications

Vaccine	End-stage renal disease, on hemodialysis[7,9]	Heart or lung disease, alcoholism[7]	Chronic liver disease[7,9]	Diabetes[7,9]
PCV13[7]				
PPSV23[7]				
HepA[8]				
HepB[9]				
MenACWY[10]				
MenB[14]				
Hib[11]				

Influenza

1 dose of age-appropriate inactivated (IIV) or recombinant (RIV) vaccine annually

- administer age-appropriate IIV or RIV to:
  - **Pregnant women**
- **Adults with egg allergy other than hives (e.g., angioedema or respiratory distress) – administer IIV or RIV in a medical setting under supervision of a health care provider**

Tetanus, diphtheria, and pertussis

- **To adults who previously did not receive a dose of tetanus toxoid, reduced diphtheria toxoid**, and acellular pertussis vaccine (Tdap) as an adult or child:
  - **1 dose of Tdap, followed by a dose of tetanus and diphtheria toxoids (Td) booster every 10 yrs.**
- **Tetanus prophylaxis in wound management**
- **Pregnant women:** 1 dose of Tdap during each pregnancy, preferably in the early part of gestational wks. 27-36.

Measles, mumps, and rubella

- **1 dose of MMR to adults with no evidence of immunity:**
  - Born after 1957 (except for health care personnel)
  - No documentation of receipt of MMR
  - No laboratory evidence of immunity or disease
- **Nonpregnant women of childbearing age with no evidence of immunity to rubella**:
  - Administer 1 dose of MMR

  MMR is contraindicated for pregnant women!!!
- **Pregnant women:**
  - administer MMR after pregnancy and before discharge from health care facility

Measles, mumps, and rubella

- **HIV infection** and CD4 cell count ≥200 cells/µL for at least 6 months and no evidence of immunity to measles, mumps, or rubella:
  - **Administer 2 doses of MMR at least 28 days apart**

MMR is contraindicated for adults with severe immunodeficiency

- **Students in postsecondary educational institutions, international travelers, and household contacts of immunocompromised persons**:
  - 2 doses of MMR at least 28 days apart (or 1 dose of MMR if previously administered 1 dose of MMR)

Measles, mumps, and rubella

- **Health care personnel born in 1957 or later with no evidence of immunity**:
  - 2 doses of MMR at least 28 days apart for measles or mumps, or 1 dose of MMR for rubella (if born before 1957, consider MMR vaccination)
- **Adults who previously received ≤2 doses of mumps containing vaccine** and are identified by public health authority to be at increased risk for mumps in an outbreak:
  - administer 1 dose of MMR

Varicella vaccination

- **Adults without evidence of immunity to varicella**
  - Born after 1980 (except for pregnant women and health care personnel)
  - No documentation of receipt of 2 doses of varicella or varicella-containing vaccine at least 4 weeks apart
  - No verification of history of varicella or herpes zoster by a health care provider
  - No laboratory evidence of immunity or disease

2 doses of varicella vaccine (VAR) 4-8 wks. apart if previously received no varicella-containing vaccine

(if previously received 1 dose of varicella-containing vaccine – 1 dose of VAR at least 4 wks. after the first dose)

Varicella vaccination

- **Health care personnel without evidence of immunity**
- **Pregnant women without evidence of immunity**:
  - Administer the first of the 2 doses or the second dose after pregnancy and before discharge from health care facility
- **Adults with HIV infection and CD4 cell count ≥200 cells/µL:**
  - May administer, based on individual clinical decision, 2 doses of VAR 3 months apart

VAR is contraindicated for pregnant women and adults with severe immunodeficiency

Zoster vaccination

- 2 doses of recombinant zoster vaccine (RZV) 2-6 months apart **to adults aged 50 years or older** regardless of past episode of herpes zoster or receipt of zoster vaccine live (ZVL)
- 2 doses of RZV 2-6 months apart to adults who previously received ZVL at least 2 months after ZVL
- for adults aged 60 years or older, administer either RZV or ZVL (RZV is preferred)

ZVL is contraindicated for pregnant women and adults with severe immunodeficiency

Human papillomavirus

- **Administer HPV to females through age 26 yrs. and males through age 21 yrs.** (males aged 22-26 years may be vaccinated based on individual clinical decision)
- The number of doses of HPV vaccine to be administered depends on age at initial HPV vaccination:
  - **No previous dose of HPV vaccine:** 3-dose series at 0, 1–2, and 6 mos. (minimum intervals: 4 wks. between doses 1 and 2, 12 wks. between doses 2 and 3, and 5 mos. between doses 1 and 3; repeat doses if given too soon)
  - Aged 9-14 years at HPV vaccine series initiation and received 1 dose or 2 doses less than 5 mos. apart: 1 dose
  - Aged 9-14 years at HPV vaccine series initiation and received 2 doses at least 5 mos. apart: no additional dose is needed

Human papillomavirus

- **Adults with immunocompromising conditions** (including HIV infection) through age 26 yrs.:
  - 3-dose series at 0, 1–2, and 6 mos.
- **Men who have sex with men** through age 26 years:
  - 2- or 3-dose series depending on age at initial vaccination;
  - if no history of HPV vaccine – 3-dose series at 0, 1-2, and 6 mos.
- **Pregnant women** through age 26 years:
  - HPV vaccination is not recommended; delay remaining doses until after pregnancy; pregnancy testing is not needed before vaccination

Pneumococcal vaccination

- **Immunocompetent adults aged 65 yrs. or older:**

  1 dose of 13-valent pneumococcal conjugate vaccine (PCV13), followed by 1 dose of 23-valent pneumococcal polysaccharide vaccine (PPSV23) at least 1 yr. after PCV13 (if PPSV23 was previously administered but not PCV13, administer PCV13 at least 1 yr. after PPSV23);

- **adults aged 19-64 yrs.** (1 dose of PPSV23) **with the following chronic conditions** :
  - **Chronic heart disease (excluding hypertension)**
  - **Chronic lung disease**
  - **Chronic liver disease**
  - **Alcoholism**
  - **Diabetes mellitus**
  - **Cigarette smoking**

Pneumococcal vaccination

- **Adults aged 19 yrs. or older with the following indications** (1 dose of PCV13 followed by 1 dose of PPSV23 at least 8 wks. after PCV13, and a second dose of PPSV23 at least 5 yrs. after the first dose of PPSV23):
  - **Immunodeficiency disorders (including B- and T-lymphocyte deficiency, complement deficiencies, and phagocytic disorders)**
  - **HIV infection**
  - **Anatomical or functional asplenia (including sickle cell disease and other hemoglobinopathies)**
  - **Chronic renal failure and nephrotic syndrome**
- **Adults aged 19 yrs. or older with the following indications** (1 dose of PCV13 followed by 1 dose of PPSV23 at least 8 wks. after PCV13):
  - **Cerebrospinal fluid leak**
  - **Cochlear implant**

Hepatitis A

- **Adults who have a specific risk, or lack a risk factor but want protection**
  - 2-dose series of single antigen hepatitis A vaccine (HepA; Havrix at 0 and 6-12 mos. or Vaqta at 0 and 6-18 mos.) or a 3-dose series of combined hepatitis A and hepatitis B vaccine (HepA-HepB) at 0, 1, and 6 mos.; minimum intervals: 4 wks. between first and second doses, 5 mos. between second and third doses
- **Healthy adults through age 40 yrs. who have recently been exposed to hepatitis A virus**
  - adults > 40 yrs. may receive HepA if hepatitis A immunoglobulin cannot be obtained

Hepatitis A

- HepA or HepA-HepB to adults with the following indications:
  - **Travel to or work in countries with high or intermediate hepatitis A endemicity**
  - **Men who have sex with men**
  - **Injection or noninjection drug use**
  - **Work with HAV in a research laboratory or with nonhuman primates infected with HAV**
  - **Clotting factor disorders**
  - **Chronic liver disease**
  - **Close, personal contact with an international adoptee** (e.g., household or regular babysitting)

Hepatitis A: PEP

- **Household and intimate contacts of individuals with acute HAV infection who refuse or cannot have HAV vaccine.**
- **HAV vaccine in the postexposure setting is as efficacious as immune globulin if given within 2 wks. of the onset of exposure for individuals 2 - 40 yrs.;**
- Vaccine-induced immunity is longer-lasting and therefore vaccine is favoured over immune globulin;
- The second vaccine dose should be given 6 to 18 mos. later to provide extended protection;
- The efficacy of immune globulin is well established but it provides only short-term protection;
- **Immune globulin** – 0.02 mL/kg body weight, deltoid injection, as early as possible after exposure.

Hepatitis B

- **Adults who have a specific risk, or lack a risk factor but want protection:**
  - 3-dose series of HepB or HepA-HepB at 0, 1, and 6 mos.
  - min intervals: 4 wks. between doses 1 and 2 for HepB and HepA-HepB; between doses 2 and 3, 8 wks. for HepB and 5 mos. for HepA-HepB

Hepatitis B

- Administer HepB or HepA-HepB to adults with the following indications:
  - **Chronic liver disease** (e.g., hepatitis C infection, cirrhosis, fatty liver disease, alcoholic liver disease, autoimmune hepatitis, ALT or AST level greater than twice the upper limit of normal)
  - **HIV infection**
  - **Percutaneous or mucosal risk of exposure to blood** (e.g., household contacts of HBsAg-positive persons; adults < 60 yrs. with diabetes mellitus or ≥ 60 yrs. or older with diabetes mellitus based on individual clinical decision; adults in predialysis care or receiving hemodialysis or peritoneal dialysis; recent or current injection drug users; health care and public safety workers at risk for exposure to blood or blood-contaminated body fluids)

Hepatitis B

- Administer HepB or HepA-HepB to adults with the following indications:
  - **Sexual exposure risk** (e.g., sex partners of HBsAg-positive persons; sexually active persons not in a mutually monogamous relationship; persons seeking evaluation or treatment for a sexually transmitted infection; MSM)
  - **Receive care in settings where a high proportion of adults have risks for hepatitis B infection** (e.g., facilities providing sexually transmitted disease treatment, drugabuse treatment and prevention services, hemodialysis and end-stage renal disease programs, institutions for developmentally disabled persons, health care settings targeting services to injection drug users or MSM, HIV testing and treatment facilities, and correctional facilities)
  - **Travel to countries with high or intermediate hepatitis B endemicity**

Meningococcal vaccination

- Administer 2 doses of MenACWY at least 8 wks. apart and revaccinate with 1 dose of MenACWY every 5 yrs., if the risk remains, to adults with the following indications:
  - **Anatomical or functional asplenia (including sickle cell disease and other hemoglobinopathies)**
  - **HIV infection**
  - **Persistent complement component deficiency**
  - **Eculizumab use**
- Administer 1 dose of MenACWY and revaccinate with 1 dose of MenACWY every 5 yrs., if the risk remains, to adults with the following indications:
  - **Travel to or live in countries where meningococcal disease is hyperendemic or epidemic, including countries in the African meningitis belt or during the Hajj**
  - **At risk from a meningococcal disease outbreak attributed to serogroup A, C, W, or Y**
  - **Microbiologists routinely exposed to Neisseria meningitides**
  - **Military recruits**
  - **First-year college students who live in residential housing** (if they did not receive MenACWY at age 16 years or older)

Meningococcal vaccination

- **MenB** may administer, based on individual clinical decision, to young adults and adolescents aged 16–23 yrs. (preferred age is 16–18 yrs.) who are not at increased risk 2-dose series of MenB-4C (Bexsero) at least 1 mo. apart or 2-dose series of MenB-FHbp (Trumenba) at least 6 mos. apart
- Administer 2-dose series of MenB-4C at least 1 mo. apart or 3-dose series of MenB-FHbp at 0, 1–2, and 6 mos. to adults with the following indications:
  - **Anatomical or functional asplenia (including sickle cell disease)**
  - **Persistent complement component deficiency**
  - **Eculizumab use**
  - **At risk from a meningococcal disease outbreak attributed to serogroup B**
  - **Microbiologists routinely exposed to Neisseria meningitidis**

Haemophilus influenzae type b

- Administer Haemophilus influenzae type b vaccine (Hib) to adults with the following indications:
  - **Anatomical or functional asplenia** (including sickle cell disease) **or undergoing elective splenectomy**: Administer 1 dose if not previously vaccinated (preferably at least 14 days before elective splenectomy)
  - **Hematopoietic stem cell transplant (HSCT)**: Administer 3-dose series with doses 4 wks. apart starting 6 to 12 mos. after successful transplant regardless of Hib vaccination history

Use of vaccines in selected populations

- Military personnel;
- Animal handlers; veterinarians;
- Children/adults in high risk locations;
- Health care workers; physicians; blood product exposure;
- Travelers to high-risk areas;
- College students;
- HIV-infected; IV drug users.

Immunization schedule for adults by medical condition and other indications

Vaccine	Health care personnel[3,4,9]	Men who have sex with men[6,8,9]
Influenza[1]		
Tdap[2] or Td[2]		
MMR[3]		
VAR[4]		
RZV[5] (preferred)		
or		
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HPV–Male[6]		2 or 3 doses through age 26 yrs
PCV13[7]		
PPSV23[7]		
HepA[8]		
HepB[9]		
MenACWY[10]		
MenB[10]		
Hib[11]		

Vaccination of Health Care Workers, WHO, 2017

Recommended

- Hepatitis B
- Polio
- Diphtheria
- Measles
- Rubella
- Meningococcal
- Influenza
- Varicella

No current recommendation

- BCG
- Pertussis
- Tetanus
- Haemophilus influenzae type b
- Pneumococcal
- Rotavirus
- HPV
- Japanese Encephalitis
- Yellow Fever
- Tick-borne Encephalitis
- Typhoid
- Cholera
- Hepatitis A
- Rabies
- Mumps
- Dengue

INTERNATIONAL CERTIFICATE OF VACCINATION OR PROPHYLAXIS
Certificat international de vaccination ou de prophylaxie

This is to certify that / Nous certifions que (1) Jane Mary Doe (name – nom); (2) 22 March 1960 (date of birth – né(e) le); F (sex – de sexe); United States (nationality – et de nationalité)

[passport number] (national identification document, if applicable – document d'identification nationale, le cas échéant)

whose signature follows / dont la signature suit (3) Jane Mary Doe

has on the date indicated been vaccinated or received prophylaxis against / a été vacciné(e) ou a reçu une prophylaxie à la date indiquée (4) Yellow Fever (name of disease or condition – nom de la maladie ou de l'affection)

in accordance with the International Health Regulations. / conformément au Règlement sanitaire international.

Vaccine or prophylaxis Vaccin ou agent prophylactique	Date	Signature and professional status of supervising clinician Signature et titre du professionel de santé responsable	Manufacturer and batch no. of vaccine or prophylaxis Fabricant du vaccin ou de l'agent prophlactique et numéro du lot	Certificate valid from: until: Certificat valable à partir du : jusqu'au :	Official stamp of the administering center Cachet officiel du centre habilité
(4) Yellow Fever	(5) 15 June 2012	(6) John M. Smith, MD	[Batch (or lot) #]	(7) 25 June 2012 24 June 2022	[(8)]

Tetanus

- **Is unique among diseases for which vaccination is routinely recommended because it is noncommunicable**;
- *Clostridium tetani* spores are ubiquitous in the environment and enter the body through nonintact skin;
- When inoculated into oxygen-poor sites (necrotic tissue as result from blunt trauma or deep puncture wounds, *C. tetani* spores germinate to vegetative bacilli that multiply and elaborate tetanospasmin;

Tetanus: Krok 2

A 45-year-old patient complains of fever up to 40°C, general weakness, headache and **spasmodic contraction of muscles in the region of a shin wound**.
The patient got injured five days ago when tilling soil and did not seek medical attention.
What kind of wound infection can be suspected?

- Anthrax
- Erysipelas
- Tetanus
- Gram-positive
- Gram-negative

- Generalized tetanus typically presents with **trismus** (lockjaw), followed by **generalized rigidity** caused by painful contractions of the skeletal muscles that can impair respiratory function.
- Glottic spasm, respiratory failure, and autonomic instability can result in death.
- Case-fatality ratio 6-72%.

Tetanus: Krok 2

A 65-y.o. woman complains of **complicated mouth opening following foot trauma 10 days ago**. Next day she ate with difficulties, there were muscles tension of back, the back of the head and abdomen. **On the third day, there was tension of all muscle groups, generalized convulsions every 10-15 min**. What is the most probable diagnosis?

- Tetania
- Meningoencephalitis
- Haemorrhagic stroke
- Epilepsy
- Tetanus

A 17-year-old young man complains of general weakness, **trismus, twitching of the muscles in his left shin**. **7 days ago he pierced his foot with a nail**. Objectively: at the sole of the foot there is a **wound, 0.3×0.2 mm in size, with small amount of serous-purulent discharge, the skin around the wound is hyperemic**. What is the most likely diagnosis?

- Phlegmon
- Osteomyelitis
- Tetanus
- Infected wound
- Erysipelas

Tetanus: Krok 2

A 38-year-old male complains of tonic tension of the masticatory muscles, so that he cannot open his mouth. **12 days before, an unknown dog bit him**.
Objectively: there is **pronounced tension and twitching of the masticatory muscles**. What is the most likely diagnosis?

- Rabies
- Hysteria
- Tetanus
- Trigeminal neuralgia
- Apyretic tetanus

On the 15-th day **after a minor trauma of the right foot**, a patient felt malaise, fatigability, irritability, headache, high body temperature, and **feeling of compression, tension and muscular twitching of his right crus**. What disease can it be?

- Anaerobic gas gangrene
- Erysipelas
- Tetanus
- Acute thrombophlebitis
- Thromboembolism of popliteal artery

Tetanus: post-exposure prophylaxis

Vaccination status	Clean, minor wounds	All other wounds
Unknown or < 3 doses of TT containing vaccine	**Tdap** and recommend catch-up vaccination	**Tdap** and recommend catch-up vaccination **Tetanus Ig**
≥ 3 doses of TT containing vaccine and < 5 yrs. since last dose	No indication	No indication
≥ 3 doses of TT containing vaccine and 5-10 yrs. since last dose	No indication	**Tdap or Td**
≥ 3 doses of TT containing vaccine and > 10 yrs. since last dose	**Tdap or Td**	**Tdap or Td**

Tetanus: Krok 2

A farmer hurt his right foot during working in a field and came to the emergency station. **He does not remember when he got last vaccination** and he has never served in the army. Examination of his right foot revealed a **contaminated wound up to 5-6 cm long with uneven edges**. The further treatment tactics will be:

- To make an injection of tetanus anatoxin
- To make an injection of antitetanus serum
- Surgical d-bridement only
- To administer an antibiotic
- To make an injection of TETANUS ANATOXIN and ANTITETANUS SERUM

Rabies

A 40-year-old patient, the forester, complains of severe headache, body temperature rise up to 39,5°C, trembling limbs. From the patient's history, we know that he had **seriously cut his hand during the dissection of a killed fox**. Objectively: depressed mood. The patient asks not to turn on the light or open the door. **Any noise causes apparent motor excitation. When he saw a carafe of water, he developed convulsive throat spasms.** What tactics should an emergency doctor choose?

- Deliver the patient to the resuscitation department
- Deliver the patient to the neurological department
- Deliver the patient to the infectious disease hospital
- Deliver the patient to the psychiatric hospital
- Let him stay at home and consult a psychiatrist

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Rabies

A 34-y.o. patient **3 hours ago was bitten by a dog**. He has a **non-bleeding wound** in his left arm caused by the dog's bite. What surgical care would you provide to the patient?

- Aseptic bandage
- Cream bandage
- Wound bathing with detergent water and antiseptic application
- Complete suturing of the wound
- Incomplete suturing of the wound

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Rabies: PEP (CDC, 2008), day 0

Unvaccinated Persons (Healthy, Immunocompetent persons, including children & pregnant women)	Previously Vaccinated Persons	Immunocompromised, Unvaccinated Persons	Immunocompromised, Previously Vaccinated Persons
Wound Cleansing Tetanus toxoid booster Human Rabies Immune Globulin (HRIG): 20 IU/kg body weight Rabies Vaccine: 1 ml	Wound Cleansing Tetanus toxoid booster Rabies Vaccine: 1 ml DO NOT GIVE HRIG	Wound Cleansing Tetanus toxoid booster Human Rabies Immune Globulin (HRIG): 20 IU/kg body weight Rabies Vaccine: 1 ml	Wound Cleansing Tetanus toxoid booster Human Rabies Immune Globulin (HRIG): 20 IU/kg body weight Rabies Vaccine: 1 ml

Rabies post exposure prophylaxis (CDC, US, 2008)

	Unvaccinated Persons (Healthy, Immunocompetent persons, including children & pregnant women)	Previously Vaccinated Persons †	Immunocompromised, Unvaccinated Persons	Immunocompromised, Previously Vaccinated Persons†
Day 1				
Day 2				
Day 3	Rabies Vaccine: 1 ml∞	Rabies Vaccine: 1 ml∞	Rabies Vaccine: 1 ml∞	Rabies Vaccine: 1 ml∞
Day 7	Rabies Vaccine: 1 ml∞		Rabies Vaccine: 1 ml∞	
Day 13				Post Vaccination Serologic Testing
Day 14	Rabies Vaccine: 1 ml		Rabies Vaccine: 1 ml	
Day 15				
Day 28			Rabies Vaccine: 1 ml	
Day 35-42			Post Vaccination Serologic Testing	

Odds and Ends

- **Hazards**
  - Use in immunocompromised patient; those with severe immune disorders
  - Patients undergoing concurrent immunosuppressive therapy
  - Use of live organisms in pregnant women
- **Side effects**
  - Local inflammation
  - Arthritis and arthralgia
  - Encephalopathy in infant
  - Local hypersensitivity

Contraindications to Vaccinations, WHO

- **Severe illness with fever;**
- NB! Malnutrition, moderate fever, respiratory infections, common diarrhoea and any other benign ailment do not constitute contraindication for vaccination;
- Discontinuation of DPT immunization is recommended in case of occurrence of a severe postvaccinal reaction as collapse, shock, fever above 40.5°C, convulsions and other neurological symptoms;
- Diarrhoea is not considered a contraindication for oral poliomyelitis vaccination;
- **No live vaccine is to be given to a person with an immunodeficiency or undergoing immunosuppressive treatment, corticosteroids therapy, radiotherapy, antimetabolite therapy, etc.**
- Measles, mumps or rubella immunization should be delayed for at least six wks. when a recent injection of polyvalent immunoglobulin has been given.

Type of vaccine	*Examples*	*Immunization principle*	*Form of protection*	*Advantages*	*Limitations*
Live (Attenuated)	Measles Mumps Rubella Varicela Polio (Sabin) Tuberculosis (BCG)	Weakened (attenuated) pathogen	Antibody production Cell-mediated immune response	Complete immune response Long-lasting immunity	Instability Risk in immunocompromised persons
Inactivated (Killed)	Influenza Polio (Salk) Pertussis	Killed (inactivated) pathogen	Antibody production	Stability Safety	Low immunogenicity (adjuvants) Shorter immunity (booster administration)
Subunit (Antigenic)	Diphteria Tetanus	Modified toxin (toxoid)			
	HBV	Recombinant antigen			
	Influenza	Purified antigens (H and N)			
Conjugated	Pneumococci Meningococci *Haemophilus influenzae* type B	Capsular polysaccharide linked to a protein (toxoid)	Antibody production (T-dependent humoral response)		
Combined (Polyvalent)	Pneumococci	Different serotypes of the same pathogen	As in single vaccines	As in single vaccines Very practical	As in single vaccines
	DTP MMR	Different pathogens			

Attenuated vs Inactivated

Feature	Attenuated	Inactivated
Preparation	Attenuation	Inactivation
Administration		
Route	Usually natural route	Parenteral
Dose	May be single	Usually multiple
Adjuvant	Not required	Usually required
Safety	May revert to virulence	Safe
Cold chain requirement	++++	++
Cost	Low	High
Duration of immunity	Usually long	May long or short
Immune response		
Humoral	IgG, IgA	Mainly IgG
CMI	+	Little or no

Post-vaccination reactions

- **Post-vaccination reactions** are unstable (short-term) functional changes in an organism as a result of preventive vaccination.
- **Post-vaccination complications** are severe and (or) persistent health problems caused by prophylactic vaccinations that go beyond the usual post-vaccination reactions.
- **Contraindications to vaccination** – a state of the human body, when after vaccination there may be postvaccinal complications or exacerbations of the disease.

Side effects and postvaccinal complications

Local

- pain
- oedema
- hyperemia
- infiltration
- -adenopathy
- nodule
- absces
- ulceration
- necroses

Systemic

- fever
- headache
- indisposition
- myalgia
- lack of appetite
- arthralgia
- sleepiness
- thrombocytopenia
- paralysis

Allergic

- generalized urticaria
- face and larynges edema
- shortness breath
- encephalopathy
- collapse
- shock

Adverse reactions

Normal toxicity	
Faulty production	Abnormal inherent toxicity Presence of foreign toxin Bacterial contamination Wrong culture used Viral contamination
Faulty administration	Use of nonsterile apparatus Contamination from operator
Allergy	Local Serum sickness Neurological illness General anaphylaxis
Other causes	Abnormal sensitivity of vaccine
Indirect effects	Damage to fetus Provocation of disease

Allergic reaction

A 16-year-old adolescent was vaccinated with DTP. In eight days, there was **stiffness and pain in the joints, subfebrile temperature, urticarial skin eruption, enlargement of inguinal, cervical lymph nodes and spleen**. What kind of allergic reaction is observed?

- Hypersensitivity of immediate type
- Immunocomplex
- Cytoxic
- Hypersensitivity of delayed type
- Autoimmune

Type III hypersensitivity - accumulation of antigen-antibody complexes that have not been adequately cleared by innate immune cells, giving rise to an inflammatory response and attraction of leukocytes. Such reactions may progress to **immune complex diseases**.

Quincke's oedema

15 minutes after the second vaccination with DTP vaccine a 4-month-old boy exhibited the symptoms of Quincke's oedema. What medication should be given for emergency aid?

- Heparin
- Adrenalin
- Prednisolone
- Furosemide
- Seduxen

Epinephrine should be used when laryngeal angioedema (allergic attack is progressing towards airway obstruction) **is suspected.**

Lyell's syndrome

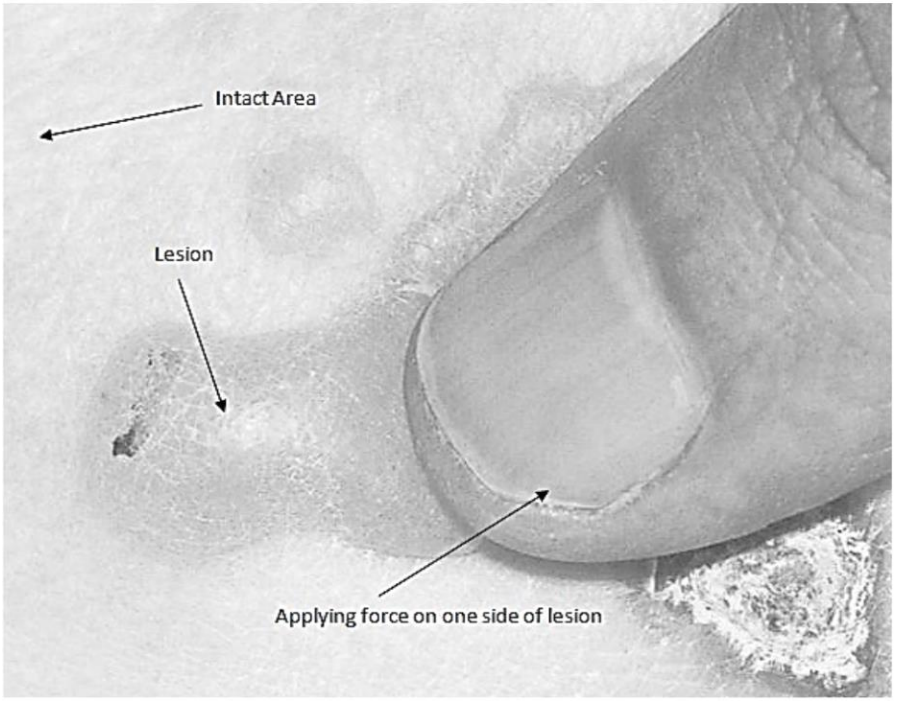
A 32-y.o. woman has the Lyell's syndrome after seasonal influenza vaccination. What immunotrope medicines are to be prescribed in this situation?

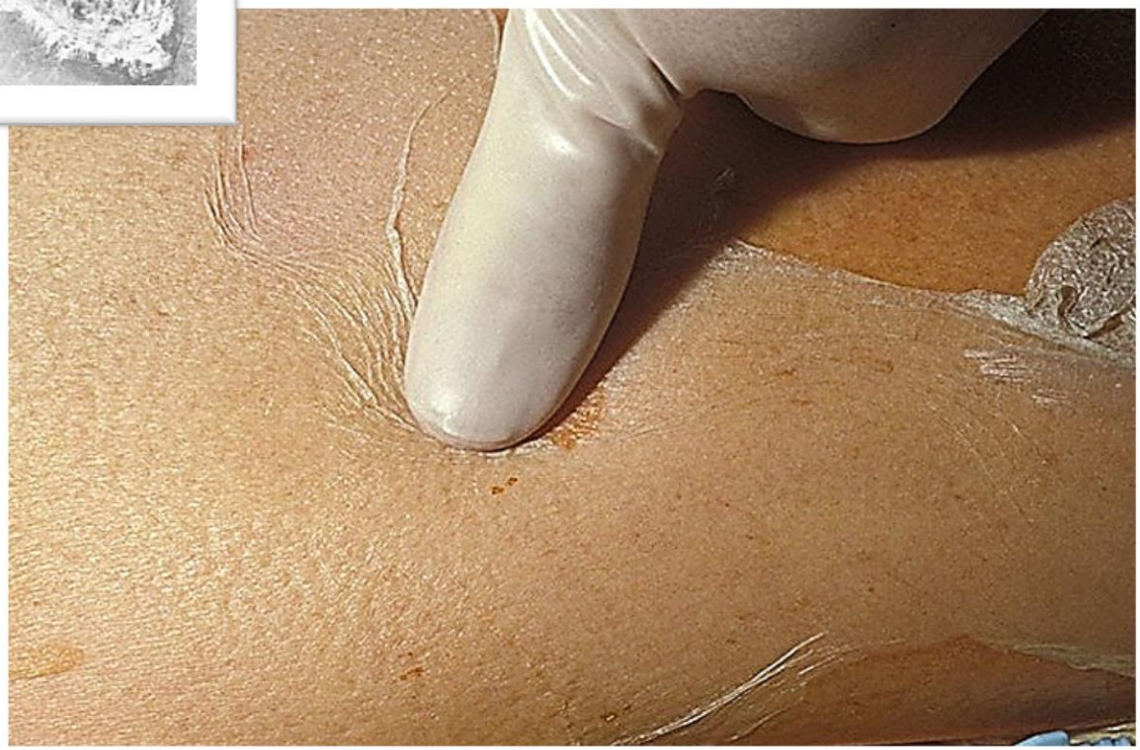
- Non-specific immune modulators
- Specific immune modulators
- Interferons
- Steroid immunosuppressants
- Non-steroid immunosupressants

Lyell's syndrome

In 12-y.o. girl 4 hours later Tdap vaccination body temperature raised up to 39-40°C. She complains of general indisposition, dizziness, sudden rash in form of red spots and blisters. Objectively: **skin lesions resemble of second-degree burns, here and there with erosive surface or epidermis peeling. Nikolsky's symptom is positive.** What is the most probable diagnosis?

- Pemphigus vulgaris
- Polymorphous exudative erythema
- Acute epidermal necrolisis
- Bullous dermatitis
- Duhring's disease


Intact Area
Lesion
Applying force on one side of lesion



Anaphylactic shock

After a 10-year-old child after seasonal influenza vaccination was delivered to a hospital. There were lip, face and neck edema. The patient felt hot and short of breath. Objectively: breathing was labored and noisy. There were foamy discharges from the mouth, cough. The skin was pale and cold. There was bradypnoea. Heart sounds were muffled and arrhythmic. Thready pulse was present. What diagnosis was made by the expert in resuscitation?

- Anaphylactic shock
- Quincke's edema
- Bronchial asthma
- Acute cardiovascular collapse
- Cerebral coma

Further advances in vaccines design

Additional ways of obtaining non-virulent antigenic substances for use as vaccines:

- Toxoids
- Recombinant DNA technology
- Conjugation to achieve immunogenicity (polysaccharides and proteins)
- Synthetic peptides
- Live viral vectors to carry pathogen genes
- Live bacterial agents to carry genes
- DNA vaccines