

Measles

Pathophysiology

- Measles- member of the genus *Morbillivirus* of the family *Parmyxoviridae*
- Is an acute highly communicable virus causing systemic infection
- The primary site of infection is the respiratory epithelium of the nasopharynx

Signs & Symptoms

- Begins with Upper respiratory symptoms: cough, sneezing, red watery eyes, runny nose, & high fever (>104 degrees Fahrenheit)
- 3-7 days post exposure a macularpapular will appear on the face
- Koplik spots are often seen and are considered pathognomonic for the disease.

Mode(s) of Transmission

- Airborne droplet transmission spread by direct contact with Nasalpharyngeal secretions of infected individuals.
- Can also be spread via articles that have been contaminated by these secretions
- Patients are contagious from 4 days before rash appears to 4 days after the rash appears
- Is considered one of the most highly contagious infectious diseases!
 - The virus remains in the air for 2 hours after it is expelled from the body.

Testing Options

- Measles-specific IgM antibody
- Measles RNA by real-time polymerase chain reaction (RT-PCR)
- Healthcare providers should obtain both a serum sample and a throat swab (or nasopharyngeal swab) from patients suspected to have measles.
- Urine samples may also contain virus, and when feasible to do so, collecting both respiratory and urine samples can increase the likelihood of detecting measles virus. (Cdc.gov)

Management & Treatment

- No specific antiviral therapy for measles.
- Treatment is supportive
 - Goal is to alleviate symptoms and address potential complications
- Severe measles cases among children should be treated with vitamin A.
 - The recommended age-specific daily doses are:
 - 50,000 IU for infants younger than 6 months of age
 - 100,000 IU for infants 6–11 months of age
 - 200,000 IU for children 12 months of age and older

Complications

- Diarrhea
- Bronchitis
- Pneumonia
- Otitis media
- Acute brain inflammation
- Corneal ulceration

Vaccine

- MMR (Measles, Mumps & Rubella)
 - One dose is about 93% effective if exposed to measles
 - Two doses are about 97% effective
- Widespread vaccination in the US has led to >99% reduction in Measles
- Most cases in the US originated outside the US or were linked to a case that originated outside the US

Vaccine Schedule

- First dose between 12 & 15 months of age
- Second dose between ages 4-6
 - Can be given earlier, but must be AT LEAST 28 days after the first dose.
- College students & health care providers with no evidence of immunity need 2 doses at least 28 days apart
- Adults with no evidence of immunity should get at least one dose.

Pathophysiology RNA paramyxovirus

- Only natural host is humans, wild strains in unvaccinated populations (12 different genotypes designated A-L)
- Disease provides life long immunity
- Vaccination – 2 doses confer life long immunity in 85% of pop. Introduced in US in 1967
- In unvaccinated countries 90% seroconvert by age 15
- Incubation period 12-25 days

Mumps: Signs & Symptoms

- Prodromal symptoms are nonspecific
 - Myalgia, anorexia, malaise, headache & low-grade fever
- Acute viral illness with fever, swelling and tenderness of one or more salivary glands
 - Parotid, sometimes sublingual or submaxillary glands
- Parotitis may be unilateral or bilateral and typically lasts 7-10 days in the unvaccinated, resolves within 1-2 weeks

Unilateral Parotitis

-

Bilateral Parotitis

Mumps: Signs & Symptoms

- Orchitis occurs in 20-30% post-pubertal males
 - Sterility rare
 - Risk factor for testicular cancer- conflicting studies
- Respiratory symptoms occur in 40-50% of kids younger than 5
- Affects males and females equally

Mode of Transmission

- By droplet spread
- Direct contact of saliva of an infected person
 - 7 days before infection to 9 days afterward
- Double dipping of appetizers!

Testing

- Usually by clinical symptoms
- Salivary mumps IgM
- Serum mumps IgM
- Serum mumps IgG
- RT-PCR – works best if collected within 2 days of symptoms regardless of vaccination status
- A negative IgM DOES NOT RULE OUT MUMPS
 - Perform no earlier than 3 days after onset of s/s

Management & Treatment

- ISOLATION- respiratory for 5 days after onset of parotitis
- Disinfect anything contaminated with saliva or nasal secretions
- Immunize susceptible contacts to reduce the likelihood of infection
- Immune globulin is not effective and not recommended and not available
- Resolves within 1-2 weeks

Management & Treatment

- Supportive care includes fever management and analgesia relief using acetaminophen or ibuprofen
- Mumps is seen as a benign viral disease in children and adults that resolves within 1-2 weeks.
- Hydration very important with young kids- feel pretty miserable.

Complications

- Orchitis
- Treatment:
 - Bedrest
 - Fluids
 - Scrotal elevation
 - Feel better in about 4-5 days

Complications

- Aseptic meningitis – 10-15%
 - 3 x more common in males
- Treatment
 - Supportive Care with adequate analgesia/antipyretics, anti-emetics and if volume depleted IV fluids
 - Usually complete recovery, but must r/o bacterial meningitis!

Complications

- Oophoritis – only in post-pubertal females
 - Fever, with loin, abdominal and/or back pain
 - Mastitis
- Treatment
- Supportive

Complications

- Mumps encephalitis – 1/100,000 cases
 - Seizures, decreased level of consciousness and focal neurological symptoms
 - Mortality is 1-5%
 - Long term morbidity is rare
- Medical Emergency

Complications

- Sensorineural hearing loss
 - High frequency loss in 4% of adult men
 - Permanent unilateral deafness 1/20,000
 - Bilateral hearing loss very rare

Complications

- Pancreatitis
- Happen approximately in 4%
 - Kids and adults
- Conservative management
 - Improves in 3-7 days

Complications

- Myocardial Involvement
 - May see ST segment depression
 - T wave inversion
 - Prolonged PR intervals
- Seen in about 15% of mumps cases

Differential

- Influenza A
- Coxsackie virus
- Acute HIV infection
- Acute suppurative parotitis
- Parotid duct obstruction

- Pregnancy
 - Increased risk of miscarriage (study from 1960) in 1st trimester –
 - No increase risk of congenital abnormalities
 - Vaccination not recommended in pregnancy

Contraindications to vaccination

- Severe immunosuppression
 - HIV
 - Congenital immunodeficiency
 - Immunosuppression due to high dose steroids or chemotherapy
 - Pregnancy

Postexposure Prophylaxis

- Immunize susceptible contacts if not immunized and no clinical history
- Unknown immunization status – immunize
 - No risk in immunizing those who are already immune

Vaccine- LAV

- 1st dose given as MMR vaccine at age of 12-18 months
- 2nd dose – second year of life to age at school entry
- Adverse reactions: fever and parotitis
- Rare: orchitis, sensorineural deafness and thrombocytopenia

Rubella

Pathophysiology

- Caused by rubella virus-a member of the Rubivirus genus of the family Togaviridae
- Is a mild febrile viral illness characterized by a diffuse punctate & maculopapular rash
- Difficult to distinguish from other febrile illnesses that present with rash
- Is only moderately contagious

Signs & Symptoms

- Maculopapular rash that begins on the face and spreads to the trunk & limbs
 - Preauricular, occipital, & posterior cervical lymphadenopathy precedes the occurrence of rash by ~5-10 days
 - Up to 50% of all cases have no rash
- Low grade fever (<101 degrees Fahrenheit)
- Arthralgia
- Headache
- Conjunctivitis
- Forcheimer's sign

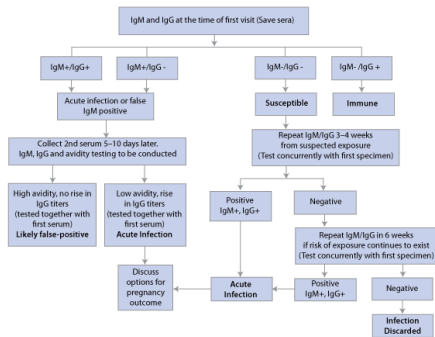
Mode(s) of Transmission

- Transmitted via airborne droplets from the upper respiratory tract
- May also be present in the urine, feces, and skin
- Can be transmitted to the fetus if Mom is infected during pregnancy

Testing Options

- Enzyme immunoassays (EIA) are the most commonly used and widely available diagnostic test for rubella.
- Rubella virus can be detected from nasal, throat, urine, blood, and cerebrospinal fluid specimens from persons with rubella
- A single serologic IgG test may be used to determine the rubella immune status of persons whose history of rubella disease or vaccination is unknown.

Interpreting Test Results



Management & Treatment

- No disease-specific treatment for Rubella
- Management is focused on symptomatic relief
- Hospitalized patients suspected of having Rubella should be placed in droplet isolation
- Hospitalized infants with CRS need to be placed in contact isolation

Complications

- Congenital Rubella Syndrome (CRS)
 - At least 20% chance of fetal complications if a mother contracts early in pregnancy
- More common in adults than children
- Arthralgia or arthritis
- Encephalitis
- Thrombocytopenic purpura
- Orchitis, neuritis, & progressive panencephalitis

Vaccine

- IMPORTANT for non-immune women who may become pregnant
- Is a live attenuated virus (RA 27/3 strain)
- 95% or more effective to provide lifelong immunity

Vaccine Schedule

- First dose at 12-15 months
- Second dose between 4-6 years of age
- Doses need to be at least 28 days apart

Postexposure prophylaxis

- Not recommended
 - Neither rubella vaccine nor immune globulin (IG) is effective for post-exposure prophylaxis of rubella.

Chicken Pox Varicella-Zoster

Varicella-Zoster Virus (VZV) Pathophysiology

- Human alpha-herpesvirus
- Causes chickenpox (varicella) & shingles (HZ)
- VZV lies dormant in dorsal root ganglia after primary infection
- Can reactivate at a later time due to illness, stress causing herpes zoster
- Childhood immunization as well as adult immunization important
- Distinct seasonal fluctuation – March to May

Varicella: Signs & Symptoms in the Unvaccinated

- Prodrome of fever, malaise, headache & abdominal pain 1-2 before rash
- Rash involves successive crops that progress within less than 24 hours from macules to papules, to vesicles, to pustules and crusts – pt will have lesions in different stages as the crops erupt
- Usually starts on face and trunk and then spread to extremities
- May have 250-500 lesions that are pruritic
- Typically ‘crops’ are crusted 4-7 days after onset of rash

Varicella: Signs & Symptoms in the Vaccinated

- *BREAKTHROUGH* Varicella – infection occurring 42 + days after vaccination
- Approx 70% of these cases very mild or undetectable
- Usual low or no fever
- Develop fewer than 50 lesions, with papules that do not generally progress to vesicles
- The other 25-30% are not mild & have clinical manifestations similar to unvaccinated

Unvaccinated individual

Vaccinated individual

Mode of Transmission

- Transmitted person to person by direct contact, droplet aerosols from vesicular lesions and respiratory tract secretions
- Incubation period: range 10-21 days after exposure to rash
- Period of contagiousness: 1-2 days before the onset of rash until all lesions are crusted, usu 5- 7 days
- Highly contagious in unvaccinated- 61-100%

Testing

- Varicella zoster virus polymerase chain reaction (PCR)
- IgG – rise is indicative of infection
- Screening adults for immunity
 - LA varicella antibody
 - Not recommended for individuals born before 1980

Management & Treatment

- Children – usually need fever management (acetaminophen) do not use NSAIDs
- Hydration is important particularly in toddlers with fever
- oatmeal baths to manage pruritus, diphenhydramine orally and topically , impeccable hygiene to prevent secondary infection
 - Skin lesions with staph or strep A- secondary infection require antibiotic treatment & close monitoring

Moderate risk of severe disease

- 13 years of age and over
- Pts with chronic skin diseases such as atopic dermatitis
- Underlying pulmonary disease
- Pts on short course or intermittent oral corticosteroids or inhaled steroids
- Pts on salicylate tx
- Start on acyclovir within the first 72 hours

High risk of severe disease

- Pts who are immunocompromised (organ transplant, chemotherapy, HIV infection)
- Neonates
- Pts using high dose systemic oral corticosteroids or immunosuppressants
- Pregnant women
- Treatment intravenous antiviral therapy STAT
- Delay in treatment can have serious consequences for these patients

Complications

- Secondary bacterial infection of skin lesions
- CNS – meningoencephalitis, cerebellar ataxia
- Pneumonia – viral or bacterial- presents 1-6 days after onset of rash w/ dyspnea, tachypnea, fever
 - Chest x-ray- nodular or interstitial changes
- Rare: Hepatitis, hemorrhagic complications, thrombocytopenia, nephritis occur less frequently

Complications

- Certain groups at increased risk for complications
 - Adults (13+)
 - Immunocompromised persons
 - Pregnant Women
 - Newborns

Fatality Rates Prior to Vaccination

Age	Cases per 100,000
1-14	1
15-19	2.7
30-49	25.2

Vaccine

- Prior to 1997 average 103 deaths per year from varicella
- After vaccine average 8 per year
- Implemented routine 2-dose childhood varicella vaccination program in 2006
- 2-doses for all adolescents and adults without evidence of immunity
- Pre-natal screening and post-partum vaccination

Varicella Vaccination

- Varicella vaccine (Varivax)
 - Approved for 12 months & older
- Measles/Mumps/Rubella/Varicella (ProQuad)
 - Approved for 12 months through 12 years
- Herpes zoster vaccine (Zostavax)
 - Approved for 50+ years

Varicella Schedule

- Routine vaccination at 12-15 months of age
- Routine second dose at 4-6 years
- Minimum interval between doses of varicella vaccine is 3 months for children younger than 13 years of age
- Adolescents & Adults
 - 2 doses separated by at least 4 weeks
 - Do not repeat 1st dose because of extended interval btw doses

Postexposure Prophylaxis

- Varicella vaccine is recommended for use in persons without evidence of varicella immunity after exposure to varicella
 - 70-100% effective if given within 3 days of exposure (possibly up to 5 days)
 - Not effective if administered more than 5 days after exposure but will produce immunity if pt is not infected

Postexposure Prophylaxis

- VariZIG- purified human immune globulin
 - Approved March 2013, Temecula Calif
 - FFF Enterprises 800-843-7477
- Immunocompromised, neonates whose moms have s/s of varicella 5 days before and 2 days after delivery
- Preterm infants exposed in neonatal period
- Pregnant women

Contraindications/Precautions to vaccination

- Severe allergic rx to vaccine component or following a prior dose
- Immunosuppression
- Pregnancy
- Moderate or severe acute illness
- Recent blood product
- Personal or family hx of seizures of any etiology (MMRV only)

Contraindications/Precautions to vaccination

- MMRV not approved for use in persons with HIV infection
- HIV infection - May be eligible for varicella and MMR depending upon age and CD4 count

Varicella Vaccine Adverse Reactions

- Local pain erythema
- Generalized rash
- Systemic reactions are not common
- Adverse rx similar for MMRV

Tetanus

Pathophysiology

- A disease caused by an endotoxin produced by the bacterium *Clostridium tetani*
- The bacterium usually enters the body via an injury causing a break in the skin (tetanus-prone wound)
- *C. tetani* produces two exotoxins:
 - Tetanolysin
 - Tetanospasmin
- The toxin binds in the CNS & interferes with neurotransmitter release to block inhibitor impulses
 - This leads to unopposed muscle contraction & spasm

Tetanus Prone Wounds

- Any wound sustained more than 6 hours prior to surgical intervention
- Compound fractures
- Deep penetrating wounds
- Any wound containing foreign bodies
- Wounds complicated by pyogenic infections
- Wounds with extensive tissue damage
- Any wound that is obviously contaminated

Signs & Symptoms

- Symptoms usually present with a descending pattern
 - Begins with trismus (AKA Lockjaw)
 - Neck stiffness
 - Difficulty swallowing
 - Rigidity of abdominal muscles
- Muscle spasms
- Fever
- Diaphoresis
- Elevated BP
- Episodic tachycardia

Mode(s) of Transmission

- Enters the body through a break in the skin
- Tetanus is NOT spreadable from person to person

Testing Options

- None
- Diagnosis is ENTIRELY based on clinical findings

Management & Treatment

- Determine circumstances of injury
- Post-exposure prophylaxis
- With confirmed cases of tetanus:
 - Maintain airway
 - Sedation if indicated
 - Muscle relaxants
 - intubation

Complications

- Laryngospasm
- Fractures
- Hypertension and/or abnormal heart rhythm
- Nosocomial infections
- Pulmonary embolism
- Aspiration pneumonia
- Death

Vaccine

- Was developed in the 1920's and first widely used during WW II.
- Consists of a formaldehyde-treated toxin
- 2 types of toxoid available:
 - Absorbed (preferred)
 - Fluid

Vaccine Schedule

- In childhood, series of 4 doses given at:
 - 2 months of age
 - 4 months of age
 - 6 months of age
 - 15-18 months of age
- Between 4-6 years of age
- Between 11-12 years of age
- Every 10 years thereafter

Postexposure prophylaxis

- Important for any tetanus prone wound
- Td or Tdap every 10 years for any at risk wound if >3 prior doses of the vaccine
- Td or Tdap in 5 years if <3 prior doses of the vaccine

DIPHTHERIA

Pathophysiology

- Caused by toxins produced by *Cornybacterium diphtheria* –must distinguish type
- Greek means ‘leather hide’ – characteristic lesion
- Toxin causes tissue destruction, usu in oropharynx, causing a pseudomembrane formation and often enters the bloodstream

Signs & Symptoms

- Throat mod to severely sore, low grade fever
- Enlarged/tender cervical lymph nodes
- Bull neck or swelling of neck (croupy cough)
- Asymmetrical adherent greyish white membrane – may extend into trachea
 - Causing airway obstruction
- Nasal diphtheria range from mild to chronic
 - Serosanguinous nasal discharge & excoriations

Incubation Period

- 2-5 days, range 1-10 days
- May involve any mucous membranes
- Leather like membrane forms within 2-3 days
- Fever not high but pt appears sicker than expected - toxic

Mode of Transmission

- Humans only reservoir
- Kissing disease
 - Spread by a Mother's kiss to her child
- Respiratory droplet
 - Coughing & sneezing
- Skin lesions (rarely)
- Inanimate objects

Testing

- Cultures from nose & throat swabs
 - Swab discolored areas, ulcerations and tonsillar crypts
- Requires selective Culture medium containing tellurite blood agar or Tindale media
- If suspicion is high begin treatment – waiting for results may result in death

Management & Treatment

- Hospitalization, close monitoring
- Call the CDC 770-488-7100
- Tx with antitoxin after obtaining from CDC
 - Antitoxin only neutralizes free toxin – so time is of the essence
 - Pt must be tested for sensitivity rx (eye or skin)
- Penicillin G IM or Erythromycin -requires a 14 day course. Pt usu receive parenteral tx until they can swallow

Management & Treatment

- Cultures will be repeated
- May require another 10 days of antibiotic tx
- All close contacts should be tested and monitored for at the very least 10 days
 - Immunization status checked and receive DTP or TD vaccine booster
 - As well as 7-10 course of erythromycin or penicillin

Management & Treatment

- Health Care providers who are in direct contact with patients should receive a Tdap booster.
- Asymptomatic carriers – may be placed in respiratory isolation or those with cutaneous colonization will require contact isolation
 - Require 10 day course of antibiotics
 - Repeat of cultures – 2 neg cultures 24 hrs apart
 - Booster of age appropriate diphtheria toxoid

Complications

- Upper airway obstruction
- Acute Respiratory failure
- Neuritis
 - Eye muscles, limbs, phrenic nerve, soft palate
- Myocarditis
- Death
 - >5 and <40 year old up to 20%

Vaccine

- Single agent is not available
- Formulations for adults (Td or Tdap) and children (DTaP or DT) or Pediarix (Dtap-HepB-IPV or Pentacel (DTaP-IPV/Hib)
- Pediatric formulations have higher doses of diphtheria toxoid

Vaccine

- Adults(7+) – never vaccinated, need series of three properly spaced Td doses
- This schedule is 95% Effective in providing protection

Dose	Interval
1 st Dose	-----
2 nd Dose	4 weeks
3 rd Dose	6-12 months

Routine DTaP Schedule

Dose	Age	Interval
1 st Dose	2 months	-----
2 nd Dose	4 months	4 weeks
3 rd Dose	6 months	4 weeks
4 th Dose	15-18 months	6 months

Children who receive DT

- If **First Dose** given to child younger than 12 months of age – **NEED 4 DOSES**
- If **First Dose** given to child at or older than 12 months of age – **NEED 3 DOSES**
- **BOOSTERS**
 - **4-6 YEARS OF AGE** – DTaP (before school)
 - **11 or 12 years of age** – Tdap
 - **Every 10 years** Td

Postexposure prophylaxis

- Case contacts must be treated as noted earlier

Pertussis – Whooping Cough

Pathophysiology

- Caused by the bacterium *Bordetella pertussis*
 - Attaches to the cilia & produces toxins that paralyze the cilia & cause inflammation and narrowing of the airways
- Is HIGHLY contagious

Signs & Symptoms

- URI that presents with a very distinctive cough
 - Inspiratory “whooping” sound
- Onset is insidious-similar to the common cold
- Fever can occur, but is usually minimal
- Stages:
 - catarrhal-Initial phase characterized by insidious onset of URI with an irritating cough
 - Paroxysmal –develops over 1-2 weeks characterized by repeated violent coughing followed by a high-pitched inspiratory “whoop”
 - Convalescence

Mode(s) of Transmission

- Airborne via respiratory droplets.
- Rarely indirectly through the air or contaminated objects
- Highly contagious in the first 2 weeks at the beginning of the paroxysmal stage

Testing Options

- Culture is the Gold Standard:
- Polymerase Chain Reaction (PCR)
- Serology
- Direct fluorescent antibody test

Management & Treatment

- Primarily supportive
- Antibiotics are of some value:
 - Azithromycin, clarithromycin, erythromycin, & Trimethoprim-sulfamethoxazole

Complications in Children

- Secondary bacterial pneumonia
- Neurologic complications
- Otitis media
- Anorexia
- Dehydration
- pneumothorax
- Epistaxis
- Subdural hematomas
- Hernias
- Rectal prolapse

Complications in Adolescents & Adults

- Sleep disturbances
- Urinary incontinence
- Pneumonia
- Rib Fracture

Vaccine

- First developed in the 1930's
- DTP is 70%-90% effective after 4 doses
- Little to no protection after 5-10 years
- Local adverse reactions are common

Vaccine Schedule

- In childhood, series of 4 doses given at:
 - 2 months of age
 - 4 months of age
 - 6 months of age
 - 15-18 months of age
- Between 4-6 years of age
- Between 11-12 years of age
- Every 10 years thereafter

Postexposure prophylaxis

- Antibiotics should be given to all close contacts of patients with pertussis
- All close contacts <7 years of age who have not yet received the 4 dose primary series should complete the series with the minimal recommended intervals.
- Close contacts between 4-6 years of age who have not yet received their 5th dose should be vaccinated.
- Efficacy of post-exposure use of Tdap is unknown

In Summary, Imagine A World
Without Vaccines
