Measles, Mumps and Rubella

Ch 10, 11 & 12

Measles

- Highly contagious viral illness
- First described in 7th century
- Near universal infection of childhood in prevaccination era
- Remains the leading cause of vaccine-preventable death in children
- Paramyxovirus (RNA)
- Rapidly inactivated by heat and light

Measles Pathogenesis and Clinical Features

- Respiratory transmission of virus
- Replication in nasopharynx and regional lymph nodes
- Primary viremia 2-3 days after exposure
- Secondary viremia 5-7 days after exposure with spread to tissues
- Incubation period 10-12 days
- Stepwise increase in fever to 103°F or higher
- Cough, coryza, conjunctivitis
- Koplik spots
- 2-4 days after prodrome, 14 days after exposure
- Maculopapular, becomes confluent
- Begins on face and head
- Persists 5-6 days
- Fades in order of appearance

Measles Complications

Condition	Percent reported
Diarrhea	8
Otitis media	7
Pneumonia	6
Encephalitis	0.1
Hospitalization	18
Death	0.2

Based on 1985-1992 surveillance data

Measles Epidemiology

• Reservoir	Human
• Transmission	Respiratory Airborne
• Temporal pattern	Peak in late winter–spring
• Communicability	4 days before to 4 days after rash onset

Measles Vaccine

- Composition — Live virus
- Efficacy — 95% (range, 90%-98%)
- Duration of Immunity — Lifelong
- Schedule — 2 doses
- Should be administered with mumps and rubella as MMR, or with mumps, rubella and varicella as MMRV

- 1941 - 894,134 U.S. cases
- 1995 - 288 U.S. cases

Vaccine Failure

- Infants vaccinated at <12m who were born to naturally-infected mothers may not develop sustained antibody levels when later revaccinated
- Primary failure
  - No seroconversion
- Secondary failure
  - Loss of protection after seroconversion

Measles Vaccine
Indications for Revaccination

- Vaccinated before the first birthday
- Vaccinated with killed measles vaccine
- Vaccinated prior to 1968 with an unknown type of vaccine
- Vaccinated with IG in addition to a further attenuated strain or vaccine of unknown type

Mumps

- Acute viral illness
- Parotitis and orchitis described by Hippocrates in 5th century BC
- Viral etiology described by Johnson and Goodpasture in 1934
- Frequent cause of outbreaks among military personnel in prevaccine era

Mumps Virus

- Paramyxovirus
- RNA virus
- One antigenic type
- Rapidly inactivated by chemical agents, heat, and ultraviolet light

Mumps Pathogenesis

- Respiratory transmission of virus
- Replication in nasopharynx and regional lymph nodes
- Viremia 12-25 days after exposure with spread to tissues
- Multiple tissues infected during viremia

Mumps Clinical Features

- Incubation period 14-18 days
- Nonspecific prodrome of myalgia, malaise, headache, low-grade fever
- Parotitis in 30%-40%
- Up to 20% of infections asymptomatic

Mumps Complications

CNS involvement	**15% of clinical cases**
Orchitis	**20%-50% in post-pubertal males**
Pancreatitis	**2%-5%**
Deafness	**1/20,000**
Death	**Average 1 per year (1980 – 1999)**

Mumps Epidemiology

- Reservoir — Human
  Asymptomatic infections may transmit
- Transmission — Respiratory drop nuclei
- Temporal pattern — Peak in late winter and spring
- Communicability — Three days before to four days after onset of active disease

Mumps Outbreak, 2006

- Source of the initial cases unknown
- Outbreak peaked in mid-April
- Median age of persons reported with mumps was 22 years
- Highest incidence was among young adults 18-24 years of age, many of whom were college students
- Transmission of mumps virus occurred in many settings, including college dormitories and healthcare facilities

Factors Contributing To Mumps Outbreak, 2006

- College campus environment
- Lack of a 2-dose MMR college entry requirement or lack of enforcement of a requirement
- Delayed recognition and diagnosis of mumps
- Mumps vaccine failure
- Vaccine might be less effective in preventing asymptomatic infection or atypical mumps than in preventing parotitis
- Waning immunity

Passive immunization against mumps

- Immune globulin ineffective for postexposure prophylaxis
  - does not prevent disease or reduce complications
- Transplacental maternal antibody appears to protect infants for first year of life

Mumps Vaccine

- Composition — Live virus (Jeryl Lynn strain)
- Efficacy — 95% (Range, 90%-97%)
- Duration of Immunity — Lifelong
- Schedule — ≥1 Dose
- Should be administered with measles and rubella (MMR) or with measles, rubella and varicella (MMRV)

Rubella

- From Latin meaning "little red"
- Discovered in 18th century - thought to be variant of measles
- First described as distinct clinical entity in German literature
- Congenital rubella syndrome (CRS) described by Gregg in 1941

Rubella Virus

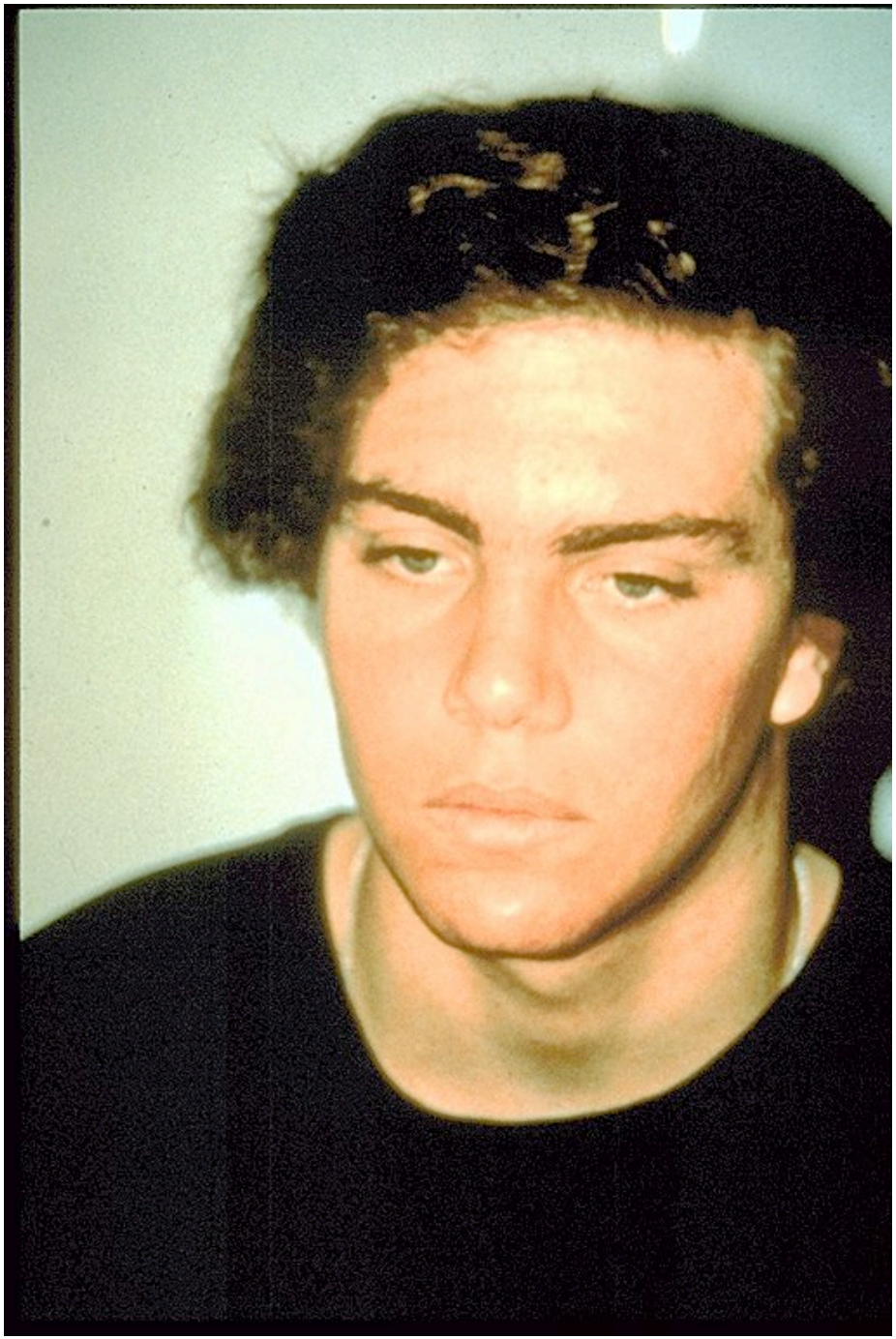
- Togavirus
- RNA virus
- One antigenic type
- Rapidly inactivated by chemical agents, ultraviolet light, low pH, and heat

Rubella Pathogenesis

- Respiratory transmission of virus
- Replication in nasopharynx and regional lymph nodes
- Viremia 5-7 days after exposure with spread to tissues
- Placenta and fetus infected during viremia

Rubella Clinical Features

- Incubation period 14 days
  (range 12-23 days)
- Prodrome of low-grade fever
- Maculopapular rash 14-17 days after exposure
- Usually quite mild



Epidemic Rubella – United States, 1964-1965

- 12.5 million rubella cases
- 2,000 encephalitis cases
- 11,250 abortions (surgical/spontaneous)
- 2,100 neonatal deaths
- 20,000 CRS cases
  - deaf - 11,600
  - blind - 3,580
  - mentally retarded - 1,800

Congenital Rubella Syndrome

- Infection may affect all organs
- May lead to fetal death or premature delivery
- Severity of damage to fetus depends on gestational age
- Up to 85% of infants affected if infected during first trimester

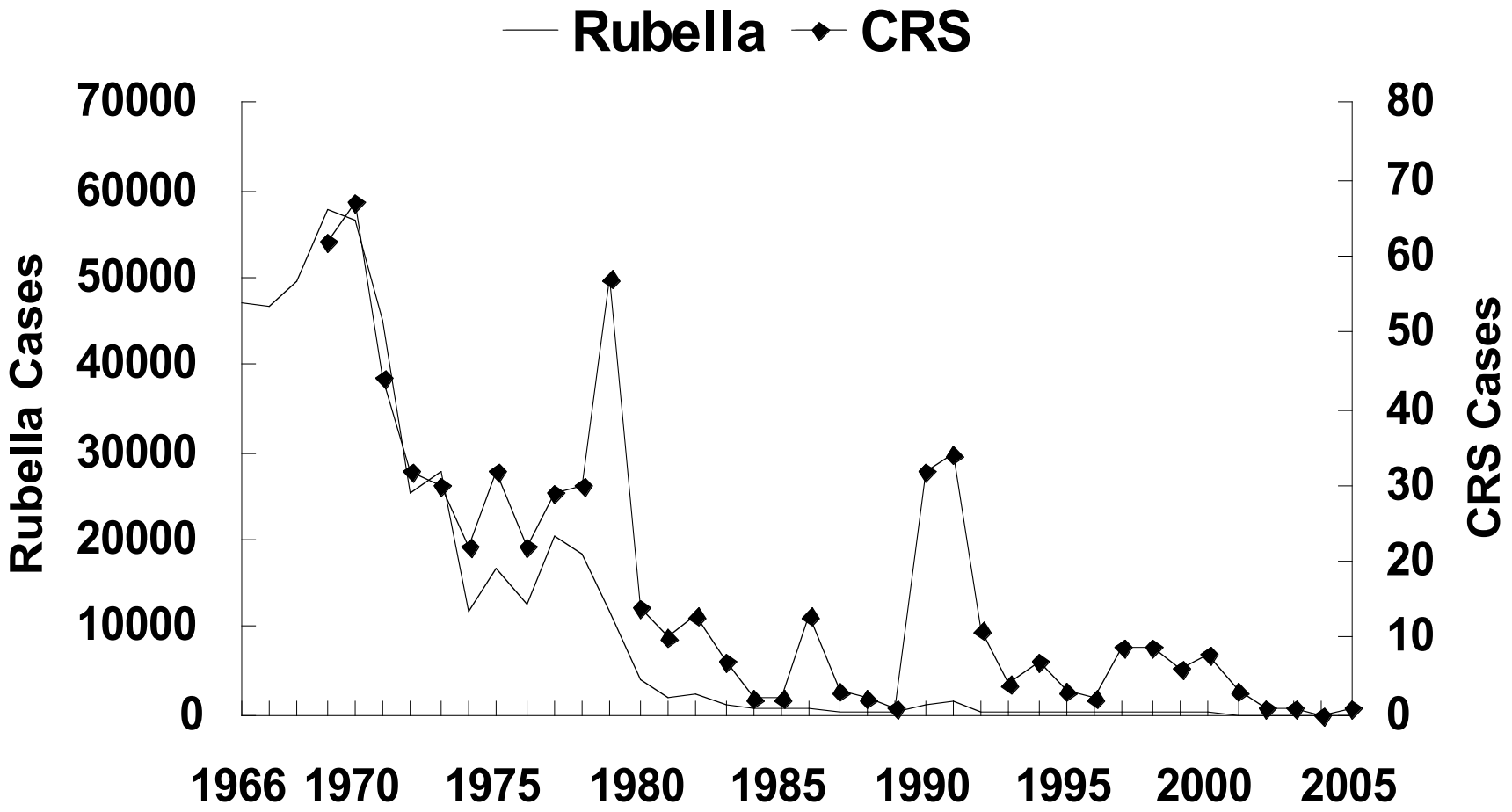
Congenital Rubella Syndrome

- Deafness
- Cataracts
- Heart defects
- Microcephaly
- Mental retardation
- Bone alterations
- Liver and spleen damage

Rubella Epidemiology

• Reservoir	Human
• Transmission	Respiratory Subclinical cases may transmit
• Temporal pattern	Peak in late winter and spring
• Communicability	7 days before to 5-7 days after rash onset Infants with CRS may shed virus for a year or more

Rubella - United States, 1966-2005



Rubella Vaccine

- Composition Live virus (RA 27/3 strain)
- Efficacy 95% (Range, 90%-97%)
- Duration of Immunity Lifelong
- Schedule At least 1 dose
- Should be administered with measles and mumps as MMR or with measles, mumps and varicella as MMRV

Rubella Vaccine Arthropathy

- Acute arthralgia in about 25% of vaccinated, susceptible adult women
- Acute arthritis-like signs and symptoms occurs in about 10% of recipients
- Rare reports of chronic or persistent symptoms
- Population-based studies have not confirmed an association with rubella vaccine

Vaccination of Women of Childbearing Age

- Ask if pregnant or likely to become so in next 4 weeks
- Exclude those who say "yes"
- For others
  - explain theoretical risks
  - vaccinate

Vaccination in Pregnancy Study 1971-1989

- 321 women vaccinated
- 324 live births
- No observed CRS
- 95% confidence limits 0%-1.2%

Measles Mumps Rubella Vaccine

- 12 -15 months is the recommended and minimum age (more effective at 15 months)
- MMR given before 12 months should not be counted as a valid dose
- 2nd dose at 4-6 years

MMR Adverse Reactions

- Fever 5%-15%
- Rash 5%
- Joint symptoms 25%
- Thrombocytopenia <1/30,000 doses
- Parotitis rare
- Deafness rare
- Encephalopathy <1/1,000,000 doses

MMR Vaccine and Autism

- Measles vaccine connection first suggested by British gastroenterologist
- Diagnosis of autism often made in second year of life
- Multiple studies have shown NO association

MMR Vaccine
Contraindications and Precautions

- Severe allergic reaction to vaccine component or following prior dose
- Pregnancy
- Immunosuppression
- Moderate or severe acute illness
- Recent blood product

Measles and Mumps Vaccines and Egg Allergy

- Measles and mumps viruses grown in chick embryo fibroblast culture
- Studies have demonstrated safety of MMR in egg allergic children
- Vaccinate without testing

Measles Vaccine and HIV Infection

- MMR recommended for persons with asymptomatic and mildly symptomatic HIV infection
- NOT recommended for those with evidence of severe immuno- suppression

MMR Vaccines

Component, per 0.5 ml dose	Measles (Attenuvax) Merck	Mumps Jeryl Lynn Strain Merck	Rubella (Meruvax) Merck	MMR-II Merck
Measles virus	>1,000 $TCID_{50}$			>1,000 $TCID_{50}$
Mumps virus		>20,000 $TCID_{50}$		>20,000 $TCID_{50}$
Rubella virus			>1,000 $TCID_{50}$	>1,000 $TCID_{50}$
Sorbitol	14.5 mg	14.5 mg	14.5 mg	14.5 mg
Sodium phosphate				
Sucrose	1.9 mg	1.9 mg	1.9 mg	1.9 mg
NaCl				
Gelatin	14.5 mg	14.5 mg	14.5 mg	14.5 mg
Human albumin	0.3 mg	0.3 mg	0.3 mg	0.3 mg
Fetal bovine serum	<1 ppm	<1 ppm	<1 ppm	<1 ppm
Neomycin	~25µg	~25µg	~25µg	~25µg