Addressing Parent Concerns and Recognizing Clinical Manifestations

RE-EMERGING PREVENTABLE DISEASE

Karen L. Schafer, DO
Family Physician

GOALS

❖ Develop an understanding of why parents are questioning childhood immunizations
❖ Develop strategies for helping parents understand the literature and alleviate fears regarding immunizations
❖ Review re-emerging preventable diseases: measles, mumps, rubella, HIB, varicella, pertussis
REVIEW

❖ How did we get here?
❖ Why is this “a thing”?
❖ How do we address parent’s concerns?
❖ Recognizing re-emerging diseases

HOW DID WE GET HERE?

❖ 1998 Lancet - Wakefield
❖ British physician (gastroenterologist)
❖ Claimed he had found virus from measles vaccines in the intestines of 12 autistic children
Retracted…

❖ Other researchers have never been able to replicate these results
❖ Further investigation revealed that Wakefield had falsified patient data and relied on lab reports that were incorrect
❖ Lancet - retracted the article from scientific literature "dishonest and irresponsible research"
❖ British authorities revoked Wakefield’s license
"The Wakefield fraud is likely to go down as one of the most serious frauds in medical history"

**WHY IS IT ‘A THING’?**

- Autism Spectrum Disorder (ASD) statistics
Possible links
- genetics
- paternal age/maternal age
- preterm and LBW babies
- hypoxic events
- Vitamin D
- changes in ASD diagnostic criteria
- younger age at diagnosis
ADDRESSING PARENT CONCERNS

❖ Ask Why?
❖ Frame the answer - emphasize the benefits directly to the child (not to society)
❖ Reassure (support the science)

“Infants get to many shots at once.”

– Grandma
❖ particles in vaccines are only **a very small amount** compared to those found in your infant’s world
❖ vaccines will **not** “overload” your child’s immune system
❖ delayed schedules have not been tested (vs ACIP guidelines)

“Vaccines have too many side effects. Besides the diseases that vaccines prevent aren’t that bad”

—Mom
Before vaccines, many infants and children died from the diseases that we can now prevent

- prevent hospitalization
- prevents illness and sequela
- **the disease is worse than the side effects from the vaccine***
“Everyone else gets vaccines, so my child doesn’t need them.”

-Dad
❖ This doesn’t mean your child could not get the illness and get seriously ill or die
❖ Review the outbreaks
❖ Spread the illness to other infants, pregnant women and the elderly

“Vaccines are not tested enough.”

– The Best Friend
Most vaccines are tested in more children and for a longer time than most medicines you give your child.
“Vaccines contain things that are not safe for my child.”

–Facebook
Thimerosal (mercury-containing compound: ethyl mercury NOT methyl mercury) has been used since the 1930s as a preservative in multi-dose vials

Ethyl mercury excreted from the body quickly, very small amount in vaccines

2001 - all vaccines changed to single dose vial - no thimerosal

Immunizations do not have mercury or thimerosal (exception is some of the multi-dose flu shots)

Aluminum is present in some, but less that what is in infant formula

“Vaccines cause autism.” 2015 Republican debate
❖ Vaccines do not cause autism

VACCINE PREVENTABLE DISEASE
MEASLES

❖ A review......

ETIOLOGY

❖ Single-stranded, lipid-enveloped RNA virus with one serotype
❖ Humans are then only host of measles virus (Rubeola)
EPIDEMIOLOGY

- Dramatic change with introduction of the vaccine (1963)
- 90% of children <15 years of age
- Attack rate 313 cases per 100,000 (1956-1960)
- Attack rate 1.3 cases per 100,000 (1982 - 1988)

  - 55,000 cases
  - 11,000 hospitalizations
  - 123 deaths
  - Resurgence due to:
    - Vaccine failure in a small number of school-aged children
    - Low coverage of preschool-age children
    - More rapid waning of maternal antibodies born to mothers who had never experienced wild-type measles infection
1993

- Implementation of 2 dose vaccine policy
- Interruption of the endemic transmission in the US in 1993
- Current rate is less than one case per million population

2011

- 222 cases of measles were reported
- 17 outbreaks (median of 4 outbreaks annually from 2001-2010)
- 200 cases were associated with importations from other countries
- 112 associated with outbreaks
- Pockets of lower coverage rates - due to parents reluctance to vaccinate their child
TRANSMISSION

- Large or small droplet aerosols suspend the virus
- Respiratory tract or conjunctivae
- Patients are infectious from 3 days before rash develops and up to 4-6 days after the onset of rash
- Virus suspended in air for up to one hour after patient has left the room
- 90% of exposed susceptible individuals will get the disease

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PATHOLOGY

- Necrosis of respiratory tract epithelium
- Small vessel vasculitis - skin and oral mucous membranes
- Lymphoid hyperplasia
- Rash - epidermal syncytial giant cells
  - “Warthin-Finkeldey giant cells” = pathognomonic for measles
PATHOGENESIS

❖ FOUR PHASES
❖ Incubation period
❖ Prodromal illness
❖ Exanthematous phase
❖ Recovery
❖ Incubation period
  ❖ primary viremia - virus disseminates to the reticuloendothelial system
  ❖ 8-12 days

❖ Prodromal phase - 2-4 days
  ❖ secondary viremia - virus spreads to body surfaces
    ❖ giant cell formation
    ❖ epithelial necrosis
    ❖ viral shedding begins
Exanthematous phase
- Antibody production begins
- Viral replication subsides
- Symptoms begin to subside

Measles

**CLINICAL MANIFESTATIONS**

Prodromal phase - mild fever
- conjunctivitis with photophobia
- coryza
- prominent cough
- increasing fever

*Koplik spots* - "pathognomonic" and appear 1-4 days prior to the onset of the rash (may spread to involve hard palate and gingiva)
Reported in 50-70% of measles cases
measles

CLINICAL MANIFESTATIONS

- red, maculopapular eruption
- rash begins on forehead, behind ears, and upper neck
- spreads to torso and extremities
- fades over 7 days
- cough lasts the longest (10 days)

LAB FINDINGS

❖ Decrease in WBC
❖ Normal ESR and CRP
❖ Serologic confirmation - IgM antibody - appears 1-2 days after the rash, remains detectable for one month
❖ Acute and convalescent IgG antibodies (4 fold rise, 2-4 weeks apart)
❖ Viral isolation from blood, urine, or respiratory secretions
❖ PCR - is available thru some state and local health departments
COMPLICATIONS

❖ Greatest in patients younger than 5 years of age, patients older than 20 years of age, and immunocompromised patients
❖ Most common cause of death in measles is pneumonia
❖ “giant cell pneumonia” vs superimposed bacterial infection
❖ Other complications:
  ◦ Croup/tracheitis/bronchiolitis
  ◦ Acute otitis media
  ◦ Diarrhea and vomiting
  ◦ Febrile seizures
  ◦ Myocarditis (rare)

❖ Encephalitis
  ◦ post infectious
  ◦ 15% of patients with measles encephalitis die
  ◦ 20-40% develop long-term sequelae
    ◦ MR
    ◦ deafness
    ◦ motor disabilities
Subacute Sclerosing Panencephalitis (SSPE)
- children and adolescents (early age exposure)
- males more than females
- Hispanic
- 7-13 years after primary measles infection (measles ab in CSF, EEG findings, post mortem brain tissue histology)
- usually fatal (1-3 years)

Measles during Pregnancy
- high rates of maternal morbidity
- fetal wastage
- stillbirths
- congenital malformations in 3-5%
TREATMENT

❖ Supportive therapy

❖ Vitamin A therapy - Administer for 2 days at high doses
  ❖ 200,000 IU daily for children 12 months of age or older;
  ❖ 100,000 IU daily for infants 6 - 11 months;
  ❖ 50,000 IU daily for younger than 6 months

MUMPS

❖ Caused by “mumps virus” - a paramyxovirus
EPIDEMIOLOGY

- Vaccine first became available in 1967
- 99% decrease since the introduction of the vaccination
- 0.25 cases per 100,000 population
- 85% of cases occur in children aged 10-15 years
- Transmitted congenitally and neonatally
- Male/Female - same frequency

THE VACCINE

- Derived from the Jeryl Lynn strain of mumps virus (attenuation by chick embryo cell cultures)
- 97% protective efficacy
CLINICAL MANIFESTATIONS

❖ Prodromal phase:
  ❖ Malaise
  ❖ Anorexia
  ❖ Headache

❖ First signs/symptoms of infection (1st week)
  ❖ parotid tenderness and swelling(sometimes bilateral)
  ❖ pain, difficulty in swallowing and speaking
  ❖ earlobe elevated, jaw angle obscured due to swelling
  ❖ redness at opening of Stenson’s duct
Gender specific manifestations

- severe pain, swelling, and tenderness of the testes in post pubertal males
- scrotal edema
- mastitis - in post pubertal females
- oophoritis
Later symptoms (weeks 1-2)
- Renal impairment (transient)
- Joint pain - poly or mono
- Unilateral deafness
- Altered level of consciousness, aphasia, seizures, encephalitis, cerebellar ataxia, transverse myelitis, Guillain-Barre syndrome
- Rare: transient pancreatitis

DIFFERENTIAL DIAGNOSIS

- Viral parotiditis - parainfluenza, coxsackie, influenza A, CMV
- Suppurative parotitis
- Salivary calculi (note: affects submandibular gland in more than 80% of the cases)
DIAGNOSTIC TESTING

- Clinical Findings
- Throat, saliva, urine or spinal fluid - viral cultures
- IgM or IgG - most commonly used
  - IgM - within the first few days of illness (diagnostic)
  - IgG - seroconversion

TREATMENT

- Acetaminophen
- For acute orchitis:
  - Prednisone may be helpful
  - Testicular bridge
  - Interferon alpha-2b (to prevent infertility) - off label
COMPLICATIONS

❖ Meningoencephalitis - occurs in approximately 10% of the cases
❖ Orchitis - 30% of post pubertal males
❖ Oophoritis - 7% of post pubertal females (no decrease in fertility)
❖ High frequency deafness - 4% of cases; unilateral deafness in 1/20,000

RUBELLA

❖ Only known true teratogenic human virus
❖ Transplacental transmission
❖ 30% spontaneous abortion or stillborn
❖ Classic triad: cardiac malformation, hearing deficits, ocular anomalies
❖ Immunization - to prevent congenital infection
CONGENITAL RUBELLA

- Early features
  - IUGR
  - Low birth weight (85%)
  - Thrombocytopenic purpura (“blueberry muffins syndrome”)
  - Hepatitis, jaundice, hepatosplenomegaly
  - Early onset cataracts, retinopathy, microphthalmia, glaucoma
  - Hearing deficits (approaches 100%) usually bilateral
  - Congenital heart defects: PDA, pulmonary artery stenosis, pulmonary valvular stenosis
  - Meningoencephalitis (20%), microcephaly
Late features
- Psychomotor retardation, behavioral disorders
- Autism
- 50 fold increase in risk for diabetes
- Malabsorption disorders
- Chronic immunologic defects

**EPIDEMIOLOGY**

- Post natal infections 0.002/1000
- In unvaccinated population, peak incidence 5-9 years of age
- In US - 50% in young adults
- Incidence has declined 99% since 1969
- 20% of the US population is currently susceptible to rubella infection
- Incidence of congenital infection in US - 0.05/1000 births
CLINICAL MANIFESTATIONS

❖ Maculopapular rash - gone in 3 days
❖ Fever, headache, anorexia
❖ Lymphadenopathy
❖ Arthralgias - high rate in adults (and lasts for weeks)
❖ Peak incidence in spring

DIAGNOSIS

❖ IgM - presence
❖ IgG - seroconversion
❖ Fetal Infection
   ❖ antibodies in fetal cord blood
   ❖ isolation of virus from amniotic fluid or
detection of viral RNA in sample of chorionic villus/amniotic fluid
TREATMENT

❖ Supportive - acetaminophen
❖ Immune globulin
❖ ? for pregnant women - does not appear to offer protection of the fetus against transplacental infection

PREGNANT WOMEN

❖ Screen for rubella antibodies
❖ Cannot immunize during pregnancy
❖ If exposed, monitor carefully for 4 weeks for lymphadenopathy, fever, rash - consider IgG prophylaxis
❖ If no illness - antibody titer should be obtained 6-8 weeks after exposure
❖ If symptoms develop - obtain nasal swab for virus isolation and then test for antibody titer in 2 weeks
❖ If infection confirmed - 80% of neonates will be infected
  ❖ close monitoring
  ❖ no effective therapy
  ❖ highest risk if exposed in the first trimester
  ❖ consider chorionic villous sampling, amniotic fluid testing
  ❖ children born to infected mothers should undergo regular hearing tests until 5 years of age
  ❖ infants with hearing loss - should be tested for rubella

❖ Newborns with congenital infection should be considered infectious for one year or until repeated nasopharyngeal and urine cultures are negative
❖ Pregnant women without immunity should be vaccinated after delivery
H. INFLUENZA

- 45-48% of all cases of bacterial meningitis now reduced to 7%
- Mortality rate 3-7%
- Children 6 years or less - peak at 6-12 months
- 90% capsular type b strain
- 90% reduction since the introduction of the vaccine

- 6 identifiable types of H. influenza (a-f) - encapsulated
- Non typeable - unencapsulated
- Gram neg coccobacillus
- Resides in nose & throat - spread by respiratory droplets
- person-to-person contact
HIGH RISK POPULATIONS

❖ American Indians
❖ Alaska natives
❖ Children < 6 years of age
❖ Adults > 65 years of age
❖ Sickle Cell
❖ Asplenia
❖ HIV
❖ Immunocompromised

HIB INFECTION

❖ Otitis media
❖ Sinusitis
❖ Epiglottitis
❖ Pneumonia
❖ Meningitis
❖ Septic arthritis
❖ Cellulitis
❖ Purulent pericarditis
**TREATMENT**

- IV third generation cephalosporins until sensitivities are available
- Adjuvant corticosteroids (Dexamethsone) in children with meningitis

**SEQUELAE**

- 3-6% of HIB cases in children are fatal
- 20% of survivors of HIB meningitis have permanent hearing loss or long-term neurologic deficits
**VARICELLA**

- Varicella-Zoster virus (alpha herpesvirus)
- Double stranded DNA virus
- Following primary infection, latency is established in sensory ganglia - cause of reactivation is unknown (shingles)
- Humans are the only known reservoir
- Incubation period 14-15 days

**EPIDEMIOLOGY**

- Incidence used to be that of the annual birth rate
- 90% of cases occur in children younger than 13
- With 2-dose vaccine series - 5 cases per 100,000
- Fewer than 14 deaths per year in US (2 per 100,000 cases) - Risk increases 15 fold for adults
- 1 million cases of Herpes Zoster
CLINICAL MANIFESTATIONS

❖ Rash** hallmark of infection
   ❖ maculopapules
   ❖ vesicles on erythematous base
   ❖ scabs
   ❖ starts on trunk and face
❖ low-grade fever
❖ malaise
❖ 1-2 weeks duration
❖ Infectious 48 hours before rash and until all vesicles are crusted

DIAGNOSTIC TESTS

❖ Clinical diagnosis (usually)
❖ Tzanck smear of lesion - sensitivity is low
❖ PCR of lesion scraping
❖ Viral culture
HIGH RISK PATIENTS

- Immunocompromised children (especially leukemia)

COMPLICATIONS

- Secondary bacterial infection (skin)
- Cerebellar ataxia - 1 in 4000 cases in children <15 years
  - ataxia, vomiting, altered speech, vertigo, tremor
  - resolution within 2-4 weeks
- Encephalitis - 0.1% - 0.2%
  - headaches, vomiting, fever, change in mental status, fever
  - Mortality - 5-20%
- Varicella pneumonitis - 1 in 400 cases in adults
  - Pregnant women in second and third trimester - most vulnerable
Perinatal varicella - maternal disease 5 days before delivery or 48 hours after
- high infant mortality - up to 30%
- Congenital varicella (uncommon)
  - skin scarring
  - hypoplastic extremities
  - CNS impairment
- Reye's syndrome

TREATMENT

- Acyclovir 20mg/kg 4 times per day for 5 days (children)
- Adults - 800mg 5 times per day
- Valacylovir/Famciclovir
PERTUSSIS

- Bordetella pertussis
- “whooping cough”
- Humans are the only reservoirs
- Highly contagious - of exposed, 80-90% will develop the disease

EPIDEMIOLOGY

- B. Pertussis still causes fatal illness among vulnerable neonates, incompletely immunized infants and the immunocompromised
- Prior to introduction of the vaccine, pertussis was one of the leading causes of death and illness in the US. It accounted for 270,000 cases and 10,000 deaths per year
- Affects all ages, but the highest frequency occurs in children younger than one year (particularly children younger than 6 months)
- The incidence of pertussis in children 7-10 years of age and adolescents has increased in the US since the introduction of acellular pertussis vaccines in the 1990s.
Reported pertussis incidence by age group: 1990-2015

Reported NNDSS pertussis cases: 1922-2015

SOURCE: CDC, National Notifiable Diseases Surveillance System and Supplemental Pertussis Surveillance System
CLINICAL MANIFESTATIONS

- Incubation period: 1-3 weeks
- Catarrhal Stage: (2-7 days)
  - Malaise
  - Low-grade or no fever
  - Anorexia, rhinorrhea, lacrimation, conjunctival injection
  - Mild, dry, non productive cough
  - Coryza and rhinorrhea

- Paroxysmal stage: (1-6 weeks)
  - Fever is minimal or absent
  - Paroxysms of cough - short, forceful expiratory bursts followed by a deep inspiration that results in the typical “whoop” (caused by inspire against an obstructed subglottis)
  - Typically 10-25 paroxysms occur over a 24 hour period (more frequent at night)
  - Other: apnea in infants, post-tussive emesis, post-tussive syncope, whooping is less common in vaccinated patients
  - Conjunctival hemorrhage and facial or upper body petechial lesions from forceful coughing may be present
Convalescent stage:
- paroxysmal cough is not as frequent or severe, but persistent dry cough is characteristic
- fatigue, weakness, and weight loss may occur followed by delayed recovery of body weight

DIAGNOSTIC TESTING
- Nasopharyngeal swab for PCR rapid testing (aspiration or polyester swab into the nasopharyngeal space)
- PCR assays are not standardized but are increasingly used because of high sensitivity, specificity, and rapid reporting results
- PCR more sensitive and rapid compared to culture
- False neg results are likely if the patient has taken antimicrobials effective against B pertussis or the onset of illness occurred more than one month prior to testing
❖ DFA (direct fluorescent antibody) - no longer recommended due to poor sensitivity
❖ Serologic testing - does not distinguish antibodies acquired through natural infection vs vaccine-induced antibodies (unless using acute and convalescent titers)
❖ cross reactivity between antibodies to Mycoplasma pneumoniae, and Hemophilus influenzae
❖ Culture (nasopharyngeal) is the only standardized test for laboratory confirmation (gold standard): 100% specific, not very sensitive (less than 50%)

❖ CDC recommendations:
  ❖ within the first 2 weeks: PCR and culture
  ❖ 3-9 weeks post symptoms: serologic testing possibly
❖ Chest X ray
  ❖ may demonstrate atelectasis - especially of the right upper lobe
  ❖ may reveal perihilar infiltrates or findings consistent with bronchopneumonia
  ❖ primary vs secondary pneumonia

DIFFERENTIAL DIAGNOSIS

❖ Bronchiolitis
❖ Bacterial pneumonia
❖ Croup
❖ Cystic fibrosis
❖ Tuberculosis
❖ Foreign body aspiration
❖ Chlamydia trachomatis or pneumonia respiratory infection
❖ Mycoplasma pneumonia
❖ Influenza
❖ Asthma
❖ Post nasal drip
TREATMENT

- Macrolides (azithromycin, clarithromycin, and erythromycin) - are the recommended antimicrobials
- For infants younger than one month of age - azithromycin is the preferred antibiotic because it has not been associated with infantile hypertrophic pyloric stenosis (IHPS) (off label)
- TMP-SMX is an alternative antibiotic for patients older than 2 months of age who cannot tolerate macrolides
- Treatment should be started prior to test results
- It is not clear if beginning antimicrobial therapy any time after 3 weeks of cough onset is beneficial
- CDC: treat persons aged older than one year within 3 weeks of cough onset; infants less than one year and pregnant women within 6 weeks of cough onset

- Hospital admission
  - cyanosis
  - persistent tachycardia or bradycardia
  - O2 desaturations following paroxysms
  - apneic episodes
  - paroxysms lasting longer than 60 seconds
  - labored breathing
  - inability to feed normally (infants)
COMPLICATIONS

- In infants younger than 6 months of age:
  - apnea
  - pneumonia
  - seizures
  - encephalopathy

- Secondary infections: otitis media, pneumonia

- Pneumonia is the leading cause of death often associated with ARDs and respiratory failure

- Other: epistaxis, hemorrhages in the central nervous system, subcutaneous emphysema, pneumothorax, umbilical and inguinal hernias, and rectal prolapse
IMMUNIZATION

❖ Adolescents Tdap - 11 to 12 years of age, and at 18
❖ Adults up to 64 years of age - one time dose of Tdap
❖ Adults 65 years of age and older - Tdap (one time)
❖ Health care providers
❖ Pregnant women should receive a dose of Tdap in the second to third trimester of gestation with EVERY pregnancy, regardless of previous history of vaccination with Tdap
❖ Post partum women who have NOT been previously vaccinated with Tdap and did not receive a dose during pregnancy

EXPOSURE

❖ Symptomatic children and staff should be removed from child care or school settings
❖ Children and staff with pertussis may return to the facility 5 days after initiation of antibiotics; or 21 days after the onset of cough (if they did not receive antibiotics)
❖ Close contacts should receive post exposure prophylaxis regardless of immunization status; unimmunized or partially immunized persons should receive the next dose in the series immediately
❖ Hospital’s infection control procedures: droplet precautions (use of a mask)
SUMMARY

The Facts in the Case of Dr. Andrew Wakefield
# Identified Prevalence of Autism Spectrum Disorder

**ADDM Network 2000 – 2012**  
**Combining Data from All Sites**

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<th>Surveillance Year</th>
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PARENT INFORMATION SITES/HANDOUTS

❖ www.immunize.org/handouts
❖ https://www.cdc.gov/vaccines/hcp/conversations (this site also lists 5 reputable studies that have found no relationship between MMR vaccine and autism)
❖ “If You Choose Not to Vaccinate Your Child, Understand the Risks and Responsibilities” - https://www.cdc.gov/vaccines/hcp/conversations
REFERENCES

- Whiteley, RJ: Mandell, Douglas, and Bennett’s Principles and Practice of Infectious Diseases, Updated Edition, 139, 1731-1737.e2
- Whiteley, RJ: Mandell, Douglas, and Bennett’s Principles and Practice of Infectious Diseases, Updated Edition, 89, 1097-1137, e10
- Mason, WH: Nelson Textbook of Pediatrics, Chapter 246, 1542-1548.e1
- Aronson, JK: Meyler’s Side Effects of Drugs, 756-775
- AAFP CME Bulletin 2016: Adolescent Immunizations and Overcoming Barriers
- Grant, WB, Cannell, JJ. Autism prevalence in the United States with respect to solar UV-B doses. Dermato-Endocrinology 5:1, 159-164