FEVER and RASH:
MORE THAN MEETS the EYE

Introduction

“RASH”

- Morbidity, hallmark of disease or morbidity
- An important indicator of critical illness
- Differentiates from non-critical illness
- Requires accurate clinical and diagnostic evaluation and appropriate management and infection control
Beware of the child with skin lesions!

- Rashes (+/- fever)
- Skin Infections
- Skin Infestations

“Rashes”
Cutaneous Manifestations of Systemic Infections
Cutaneous Manifestations of Systemic Infections (“Rashes”)

- Rashes: caused by many different types of viruses, bacteria, fungi, protozoan and metazoan agents

- Exanthem: often offers important clues to the etiology of a patient’s illness

- By skin examination alone, it is difficult to differentiate a “rash” from a systemic infection vs primary cutaneous (local) diseases

Important Aspects in the Diagnosis of Exanthematous Illness

- Exposure
- Season
- Incubation Period
- Age
- Previous exanths
- Relationship of rash to fever
- Adenopathy

- Type of rash
- Distribution of rash
- Progression of rash
- Enanthem
- Other associated sx
- Laboratory tests
# Erythematous Macular Exanthems

<table>
<thead>
<tr>
<th>Infectious Agent</th>
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<tbody>
<tr>
<td>Human herpes virus 6, 7</td>
<td>Roseola Infantum</td>
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<tr>
<td>Epstein-Barr virus</td>
<td>Infectious mononucleosis</td>
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<tr>
<td>Parvovirus</td>
<td>Erythema infectiosum</td>
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<tr>
<td>Coxsackie viruses B1, B2, B5</td>
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<tr>
<td>Echoviruses 2, 4, 5, 14, 17-19, 30</td>
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<tr>
<td>Enterovirus 71</td>
<td>Dengue Fever</td>
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<td>Dengue virus</td>
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<td>Mycoplasma pneumoniae</td>
<td>Septicemia and toxic shock synd</td>
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<td>Staphylococcus aureus</td>
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<td>Salmonella typhi</td>
<td>Typhoid Fever</td>
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<tr>
<td>Leptospira species</td>
<td>Leptospirosis</td>
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</tbody>
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# Typhoid Fever

- Fever, headache, anorexia, malaise, abdominal pain, “Rose spots”
- abdomen, less on chest and back
- 2-4mm erythematous macular lesions
## Erythematous Maculopapular Exanthems

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<td>Coxsackieviruses A2, A4, A7, A16, B1-B5</td>
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</tr>
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<tr>
<td>Rubella virus</td>
<td>German Measles</td>
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<tr>
<td>Mumps virus</td>
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<tr>
<td>Measles virus</td>
<td>Measles</td>
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<tr>
<td>Hepatitis B virus</td>
<td>Hepatitis</td>
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<tr>
<td>Mycoplasma pneumoniae</td>
<td>Staphylococcal Scarlet Fever</td>
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<tr>
<td>Staphylococcus aureus</td>
<td>Scarlet Fever</td>
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<tr>
<td>Streptococcus pyogenes</td>
<td>Meningococcemia</td>
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<tr>
<td>Neisseria meningitidis</td>
<td>Cat-scratch fever</td>
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<tr>
<td>Bartonella henselae</td>
<td>Secondary syphilis</td>
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<td>Treponema pallidum</td>
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## Measles (Rubeola)

- Fever, cough, coryza, conjunctivitis, maculopapular rash, "Koplik spots"
**Measles (Rubeola)**

Airborne precautions until 4 days after the onset of rash and the duration of illness for immunocompromised patients.

**German Measles (Rubella)**

- Mild, slight fever, maculopapular rash, generalized lymphadenopathy
- Rash:
  - Cephalocaudal spread
  - Lasts approx. 3 days
German Measles (Rubella)

- Droplet precautions until 7 days after onset of rash

Adolescent females:
commonly with polyarthralgia/polyarthritis

Roseola infantum
(Exantheme subitum, Human herpesvirus 6)

- High fever (3-7 days), followed by maculopapular rash lasting for hours to days, (10-15% with seizures)
- Lymphadenopathy, GIT/RT sx, inflamed lympnanic membrane, +/- bulging anterior fontanelle
- Virus may persist and reactivates
**Roseola infantum**  
(Exanthem subitum, Human herpesvirus 6)

Standard precautions

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**Vesicular Exanthems**

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<tr>
<td>Herpes simplex virus type 1 and 2</td>
<td>Cold sores, genital herpes, or neonatal</td>
</tr>
<tr>
<td>Varicella-zoster virus</td>
<td>Chickenpox or herpes zoster</td>
</tr>
<tr>
<td>Orf virus</td>
<td>Smallpox</td>
</tr>
<tr>
<td>Coxsackieviruses A4, A5, A8, A10, A16</td>
<td>Ecthyma contagiosum</td>
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<td>Mumps virus</td>
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<tr>
<td>Measles virus</td>
<td>Atypical measles</td>
</tr>
<tr>
<td>Streptococcus pyogenes</td>
<td>Impetigo</td>
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<tr>
<td>Bacillus anthracis</td>
<td>Anthrax</td>
</tr>
<tr>
<td>Mycobacterium tuberculosis</td>
<td>Papulonecrotic tuberculids</td>
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<tr>
<td>Candida albicans</td>
<td>Congenital cutaneous candidiasis</td>
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<tr>
<td>Necator americanus</td>
<td>Hookworm disease</td>
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**Chickenpox**
*(Varicella zoster)*

Generalized, pruritic vesicular rash, mild fever

Airborne and contact precautions - minimum of 5 days after onset of rash until all lesions are crusted.

**Herpes simplex**
*1 and 2*

Most common clinical manifestation in children = gingivostomatitis
(fever, irritability, tender submandibular adenopathy, ulcerative enanthem on gingiva and mucous membranes of mouth, and perioral vesicular lesions)
Herpes simplex 1 and 2

Contact precautions during duration of illness.

Sucking blisters

Recurrent herpes simplex periorbital vesicles

Hand, Foot, and Mouth Syndrome

- Vesicular lesions in the anterior of the mouth and on the hands and feet
- +/- fever, sore mouth, anorexia, malaise, abdominal pain
- Enteroviruses, HSV, but commonly Coxsackievirus A16
Hand, Foot, and Mouth Syndrome

Contact precautions for
the duration of illness

Petechial and Purpuric Exanthems

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<td>Hemorrhagic chickenpox</td>
</tr>
<tr>
<td>Cytomegalovirus</td>
<td>Congenital cytomegalovirus infection</td>
</tr>
<tr>
<td>Coxsackieviruses A4, A9, B2-B4</td>
<td>Rubella or congenital rubella</td>
</tr>
<tr>
<td>Echoviruses 4, 7, 9</td>
<td>Hemorrhagic or atypical measles</td>
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<td>Rubella virus</td>
<td>Scarlet fever or septicemia</td>
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Meningococcemia

Abrupt onset of fever, chills, malaise, rash (macular → petechial)
Fulminant - DIC, shock, coma, death within hours

Flu-like illness followed within 48 hrs by a rash in 70-90% of patients
> petechial/purpuric 60-70%
> maculopapular in 10-15%
> purpura fulminans in 5-10%

Chemoprophylaxis for those at high risk warranted within 24 hours of diagnosis of case.

Meningococcemia

Droplet precautions until 24 hours after initiation of effective antimicrobial therapy
Hemorrhagic Chickenpox

Hemorrhagic varicella common in immunocompromised hosts.

FEVER AND RASH IN CHILDREN

MA. CARMEN NIEVERA, MD, DPIDSP
Pediatric Infectious Disease Specialist

MA. TERESITA GABRIEL, MD, FPDS
Dermatologist
**Definition**

- Acute, febrile, self-limited, systemic vasculitis of unknown etiology that occurs predominantly in infants and young children, diagnosed based on characteristic clinical symptoms.

- Dr. Tomisaku Kawasaki 1967
  “febrile oculo-or-o-cutaneo-acrodesquamatos syndrome with or without nonsuppurative cervical lymphadenitis”
**Epidemiology**

- **Endemic and community-wide epidemic forms**
- **Children of all races**
  
  Japanese > Asians and Pacific islanders > African Americans >
  Hispanics > Caucasians
- **Leading cause of acquired heart disease in children**
- **Evidence of familial susceptibility:**
  Patients with parents who also had KD:
  - Increased odds for + sibling cases (OR 6.94)
  - Mean age of onset younger than parents
  - More likely for recurrence, retreatment, complications


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**Epidemiology**

- **Usual age range:** *1 to 5 years old*
  - Median: 2 years old (20 days old – 31 yrs old)
  - **Boys** (1.5 to 1.7) > girls (1)
- **Recurrence rate:** 1.3 - 3%
- **Rate in a sibling:** 2.1% (within 1 year)
- **Seasonality:**
  - US: winter and early spring
- **Reports of associations with:**
  - Antecedent respiratory illness
  - Exposure to carpet-cleaning fluids, rugs, tatami mats
  - Preexisting eczema
  - Using humidifier
  - Living near standing body of water

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RB. 4 y/o Female
Cc: desquamation
3 weeks PTC
/barb2right
patient developed high grade fever w/ no other symptoms
Consult at local health center Dx: undisclosed
Given Paracetamol (dose unrecalled), no lysis of fever
20 days PTC
/barb2right
(+) persistence of fever w/ non-productive cough,
(+) appearance of erythematous morbiliform rash on the abdomen spreading to arms and legs sparing the face
(+) pruritus
15 days PTC
/barb2right
persistence of symptoms prompted consult at RITM (ER)
Dx: Measles, Given Paracetamol, Ambroxol, 1 tsp TID and Hydroxyzine 1 tsp TID x 2 days.
12 days PTC
/barb2right
(+) persistence of fever
(+) appearance of fine scaly patches on trunk, arms, legs, hands & feet
8 days PTC
/barb2right
(+) persistence of fever (mid-afternoon to early morning),
(+) odynophagia associated w/ 1 episode of vomiting, (+) headache,
cough and colds, (+) desquamation

KAWASAKI DISEASE
Diagnostic Criteria

Persistent fever (>5 days) = > 38.3 °C
→ 100%

Plus 4 out of 5 conditions:
1. Bilateral conjunctivitis (non-purulent) → 92%
2. Oral mucosa involvement:
   (injected or fissured lips, injected pharynx or strawberry tongue)
   → 100%
3. Peripheral extremity changes → 72%
4. Rash (polymorphous) → 100%
5. Cervical lymphadenopathy → 72%

Clinical and Laboratory Findings

• Fever:
  – CDC: Fever (>38.5 rectally) present for at least 5 days without other explanation
  – Day 1 = 1st day of fever
  – High-spiking, remittent
  – 39 to 40°C
  – Untreated: Persists for mean of 11 days (may extend to 3 to 4 weeks)
  – Treated: usually resolves in 2 days
Clinical and Laboratory Findings

1. Changes in extremities (at least one of the following):
   - Acute phase:
     • Erythema of palms and soles (80%)
     • Firm, painful induration of hands and/or feet (67%)
   - Subacute (2 to 3 weeks after onset of fever):
     • Desquamation of fingers and toes (29%)
     • Periungual region → palms and soles
   - Convalescent (1-2 months after onset of fever):
     • Beau’s lines (deep transverse grooves across the nails)

(Kawasaki Disease)

Swelling of the dorsum of the hand associated with fusiform swelling of the digits. Erythema of the PIP and DIP joints suggests small joint arthritis.
Diffuse erythema of the palm. This finding is usually bilateral and may fluctuate in intensity with the height of the fever. Unlike the rash on other parts of the body, there is no pattern to the erythema.

Periungual desquamation of a patient with Kawasaki syndrome.

Desquamation of the skin of the distal fingers following Kawasaki syndrome in a 4-year-old boy.

Desquamation of the skin over the abdomen.
Clinical and Laboratory Findings

2. Polymorphous exanthem (92%):
   -- Appears within 5 days of fever
   -- Various forms:
     • Nonspecific, diffuse, maculopapular (common)
     • Others:
       -- Urticarial exanthem
       -- Scarlatiniform rash
       -- Erythroderma
       -- Erythema-multiforme-like rash
       -- Fine micropustular eruption
       -- NOT DESCRIBED: bullous, vesicular
     • Extensive:
       -- Face, trunk, extremities, perineal accentuation

(Kawasaki Disease)

Characteristic distribution of erythroderma of Kawasaki syndrome. The rash is accentuated in the perineal area in approximately two thirds of patients.
Micropustular rash of Kawasaki disease with petechiae. This unusual rash is uncommon but is quite specific for Kawasaki disease. Tiny micropustules can be seen when a beam of light is shined tangentially across the skin.

Accentuation of rash in groin associated with desquamation during acute Kawasaki disease (seen in 50% of KD patients).
Clinical and Laboratory Findings

3. Conjunctival injection:
   - Bilateral, painless
   - Begins shortly after fever onset
   - Bulbar conjunctivae
   - Spares limbus
   - NOT SEEN: exudate / conjunctival edema / corneal ulceration
   - Keratitis is seen in the minority of patients.
   - Resolves rapidly
   - 94%: percentage of U.S. patients manifesting this clinical sign within the first ten days after onset of fever.

Burns, et al.,

(Kawasaki Disease)

Characteristic bilateral, non-exudative conjunctivitis associated with KD. Note the perilimbal sparing with a halo of white around the iris. The dry conjunctivitis of KD is virtually pathognomonic for this systemic vasculitis.
Clinical and Laboratory Findings

4. Changes of lips and oral cavity
   (at least one of the following):
   - Lips: erythema, dryness, fissuring, peeling, cracking, and bleeding (70%)
   - “strawberry tongue” (71%)
   - Diffuse oropharyngeal erythema without discrete lesions (70%)
   - NOT SEEN: ulcerations and exudates

(Kawasaki Disease)

Characteristic cutaneous and mucous membrane changes of Kawasaki syndrome.
Clinical and Laboratory Findings

5. Cervical lymphadenopathy :
   - Least common (42%)
   - Usually unilateral
   - Anterior cervical triangle
   - ≥1 lymph node that is ≥1.5 cm in diam.
   - Firm, nonfluctuant, non-suppurative
   - No associated erythema
   - Nontender or slightly tender

Other clinical and laboratory findings

- **Cardiovascular findings**
  - Congestive heart failure, myocarditis, pericarditis, valvular regurgitation
  - Coronary artery abnormalities
  - Aneurysms of medium-size noncoronary arteries
    - (subclavian, brachial, axillary, iliac, femoral, abdominal aorta, renal arteries)
  - Raynaud’s phenomenon
  - Peripheral gangrene
- **Musculoskeletal system**
  - Arthritis, arthralgia
- **Gastrointestinal tract**
  - Diarrhea, vomiting, abdominal pain
  - Hepatic dysfunction, obstructive jaundice
  - **Hydrops of gallbladder**
Other clinical and laboratory findings

- **Central Nervous System**
  - Extreme irritability
  - Aseptic meningitis
  - Sensorineural hearing loss
  - Facial nerve palsy
- **Genitourinary system**
  - Urethritis/meatitis
- **Other findings**
  - Erythema, induration at BCG inoculation site
  - Anterior uveitis (mild)
  - Desquamating rash in groin

Laboratory findings in Acute Kawasaki disease

- Leukocytosis with neutrophilia and immature forms
- Elevated ESR
- Elevated CRP
- Anemia
- Abnormal plasma lipids
- Hypoalbuminemia
- Hyponatremia
- Thrombocytosis after week 1
- Sterile pyuria
- Elevated serum transaminases
- Elevated serum gamma glutamyl transpeptidase
- Pleocytosis of cerebrospinal fluid
- Leukocytosis in synovial fluid
Laboratory findings in Acute Kawasaki disease:

- **Thrombocytosis:**
  - 500,000 to > 1 million/mm³
  - Mean: 700,000/mm³
  - Usually in 2nd week
  - Peaks in 3rd week
  - Returns to normal by 4 to 8 weeks

- **Thrombocytopenia:**
  - May be a sign of DIC
  - Risk factor for coronary aneurysms

Clinical Phases of Illness:

**ACUTE PHASE** → **SUBACUTE PHASE** → **CONVALESCENT PHASE**

- **Fever**, rash, conjunctival injection, strawberry tongue, erythema/edema of hands and feet, lymphadenitis, aseptic meningitis, myocarditis, pericardial effusion, hepatic dysfunction

- Fever and physical findings disappear, irritable, anorexic, arthritis, desquamation, thrombocytosis

- All clinical signs and symptoms disappear, until ESR returns to normal.

- 8 to 30 days → 2 to 4 weeks → 6 to 8 weeks

  **Greatest risk for sudden death**
\textbf{Therapeutic Options}

\begin{itemize}
  \item \textbf{Recommended:}
    \begin{itemize}
      \item IVIG - 2g/kg over 10 to 12 hours as a single dose combined with ASA
        - Old dosaging - 400 mg/kg/day over 2h x 4 consecutive days
      \item Aspirin (ASA)
        - 80mg to 100 mg/kg/day in four divided doses
        - 3 to 5 mg/kg/day continued for 6 to 8 weeks after onset of illness
        - indefinitely for coronary artery abnormalities
      \item Emollients for desquamating skin
      \item Antihistamine for pruritus
      \item IV Methylprednisolone
        - pulse dose of 30mg/kg for 30 days (if fever persists after two or three
doses of IVIG.
    \end{itemize}
  \item \textbf{CURRENT STANDARD:}
    - IVIG 2 g/kg plus salicylates before day 10 of fever
\end{itemize}

\textbf{Treatment}
\textbf{(Acute and Subacute Stages)}

\textbf{1. Aspirin}
\begin{itemize}
  \item Does not lower frequency of coronary aneurysms
  \item ASA + IVIG = additive effect
  \item \textbf{High dose} (anti-inflammatory):
    \begin{itemize}
      \item 80-100 mg/kg/day in four divided doses
      \item High dose until 14\textsuperscript{th} illness day and patient afebrile at least 2-4
days; until afebrile for 3-4 days; until afebrile for 4-5 days
    \end{itemize}
  \item \textbf{Low dose} (anti-thrombotic):
    \begin{itemize}
      \item 3-5mg/kg once daily for 6-8 weeks
      \item Maintain indefinitely if patient has coronary abnormalities
    \end{itemize}
  \item Reminders:
    \begin{itemize}
      \item Ibuprofen antagonizes ASA irreversible platelet inhibition.
      \item Risk of Reye Syndrome:
        \begin{itemize}
          \item high dose ASA + active Varicella or Influenza
          \item Annual Influenza Vaccine
          \item Avoid ASA 6 weeks after Varicella Vaccine
        \end{itemize}
    \end{itemize}
\end{itemize}
**Treatment**
*(Acute and Subacute Stages)*

2. **Intravenous gamma globulin (IVIG)**
   - **Mechanism:** unknown
     (generalized anti-inflammatory effect)
   - **2 g/kg single infusion over 10-12 hours**
     - Within 1st 7-10 days of illness
     - Tx within <5 days → increased need for IVIG retreatment.
     - Give after 10th day of illness if + persistent fever, aneurysm, ongoing systemic inflammation.
     - IVIG may be repeated if fever persists or recurs together with at least one classic sign of Kawasaki disease
   - **Adverse effects** – vary among products
   - **Defer measles and varicella immunization ≥ 11 months after IVIG administration**
   - **Sequelae:**
     - 5% → transient coronary dilation
     - 1% → coronary aneurysm

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**Complications**

1. **Coronary Artery Aneurysm**
   - Untreated = 20-25%
   - Treated = 2%

2. **Neurologic**
   - 1-30% of cases
   - Aseptic meningitis (26-50%)
   - Seizures
   - Increased ICP
   - Ataxia
Complications

- Death - 1-2% of all cases
  - within 2 months of DX.
  - Acute myocarditis
  - Cardiac arrhythmia
  - Myocardial Infarction
- Early recognition
- Prompt management
  - reduce morbidity
    - reduce inflammation in the myocardial wall
  - prevent mortality (prevent coronary thrombosis)

Meningococcemia
Meningococcal Disease

- *Neisseria meningitidis* (gram negative diplococcus)
- **Incubation period**: 1 – 10 days (< 4 days)
- **Epidemiology**:
  - Most cases of meningococcal disease are endemic
  - <5% associated with outbreaks
  - A, B, C, Y, W-135 most commonly implicated in invasive disease worldwide
  - Peak ages of attack:
    - < 1 year old and 15 – 18 years old


Meningococcal Disease

- **Fulminant case (meningococcemia)**:
  - purpura, limb ischemia, coagulopathy, pulmonary edema, shock, coma, death within hours

- **Meningococcal meningitis**:
  - ssxs indistinguishable from meningitis caused by *S. pneumoniae* and other meningeal pathogens

Meningococcal Disease

- **Associated with Death:**
  - young age, absence of meningitis, coma, hypotension, leukopenia, thrombocytopenia
- **Case fatality rate:** 10%
- **Less common:**
  - pneumonia, febrile occult bacteremia, conjunctivitis, septic arthritis, chronic meningococcemia
- **Invasive meningococcal infections:**
  - arthritis, myocarditis, pericarditis, endophthalmitis
- **Sequelae:** 11 – 19%
  - Hearing loss, neurologic disability, digit or limb amputations, skin scarring


Maculopapular and petechial rash
- Indistinguishable from rash of other viral infections

Purpuric rash – occurs in severe sepsis
- May be caused by other bacterial pathogens, including *S. pneumoniae*

Disease progression: rapid!
Meningococcal Disease

**Diagnostic Tests:**
- **Gram stain** (may be helpful)
  - Petechial/purpuric scraping, CSF
  - Buffy coat smear of blood
- **Culture** (diagnostic)
  - Blood, CSF
  - Petechial/purpuric lesion scraping
- **Nasopharyngeal swab** – not helpful
- **CSF Bacterial antigen detection**
  - helpful if clinically compatible
- **PCR** of clinical specimens when available

**Treatment:**
- Treat shock and raised intracranial pressure!
- Empiric tx: **Cefotaxime or Ceftriaxone**
- Etiology confirmed:
  - **Penicillin G** (drug of choice)
    - 250,000-300,000 U/kg/day max: 12 mil U/day div q 4-6 hours
  - Alternatives: Cefotaxime, Ceftriaxone, Ampicillin
  - 5 to 7 days antimicrobial treatment
  - **Ceftriaxone** – most cost effective
    - Reduced nursing time, single daily dose
    - Clears CSF rapidly
    - Clears nasopharyngeal carriage after 1 dose

Meningococcal Disease

• **Infection Control:**
  - Standard precautions
  - Droplet precautions until after 24 hrs of effective antimicrobial therapy
  - Chemoprophylaxis


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Invasive Meningococcal Disease: Case Definitions

• **Confirmed**
  - Clinically compatible case, and
  - Isolation of N meningitidis from a sterile site (blood, CSF, pleural fluid, skin lesions)

• **Probable**
  - Clinically compatible case, and
  - +antigen test/immunohistochemistry/PCR

• **Suspect**
  - Clinically compatible case and gm(-) stain in any sterile fluid (CSF, synovial fluid) or skin lesion
  - Clinical purpura fulminans without + culture

Disease Risk for Contacts of People with Meningococcal Disease

**High Risk:** chemoprophylaxis recommended (close contacts)
- **Household contact** (specially children <2yrs)
- **Childcare/preschool contact** within 7 days of onset of illness
- **Direct exposure to patient’s secretions** (kissing, sharing toothbrushes, eating utensils) within 7 days of onset of illness
- **Mouth-to-mouth resuscitation, unprotected contact** during ET intubation within 7 days of illness
- **Frequently slept in same dwelling** as patient within 7 days of illness
- Passengers seated directly next to patient during airline flights lasting > 8 hrs

**Low Risk:** chemoprophylaxis NOT recommended
- **Casual contact:** no direct exposure to patient’s secretions
- **Indirect contact:** only contact is with high-risk contact, no direct contact with patient
- **Healthcare professionals without direct exposure** to patient’s secretions

**In outbreak or cluster**
- Chemoprophylaxis for people other than people at high risk should be administered only after consultation with local public health authorities

### Recommended Chemoprophylaxis for High Risk Contacts and People with Invasive Meningococcal Disease

<table>
<thead>
<tr>
<th>Age of child/ adult</th>
<th>Dose</th>
<th>Duration</th>
<th>Efficacy (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Rifampicin</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>&lt; 1 mo</td>
<td>5mg/kg q 12h PO</td>
<td>2 days</td>
<td>90-95</td>
</tr>
<tr>
<td>&gt; 1 mo</td>
<td>10mg/kg (max 600mg) q 12h PO</td>
<td>2 days</td>
<td></td>
</tr>
<tr>
<td><strong>Ceftriaxone</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>&lt;15 y</td>
<td>125mg IM</td>
<td>Single dose</td>
<td>90-95</td>
</tr>
<tr>
<td>&gt;15 y</td>
<td>250mg IM</td>
<td>Single dose</td>
<td></td>
</tr>
</tbody>
</table>


### Recommended Chemoprophylaxis for High Risk Contacts and People with Invasive Meningococcal Disease

<table>
<thead>
<tr>
<th>Age of child/ adult</th>
<th>Dose</th>
<th>Duration</th>
<th>Efficacy (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Ciprofloxacin</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>&gt;1 mo</td>
<td>20mg/kg (max 500mg) PO</td>
<td>Single dose</td>
<td>90-95</td>
</tr>
<tr>
<td><strong>Azithromycin</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>10mg/kg (max 500mg) PO</td>
<td>Single dose</td>
<td>90</td>
</tr>
</tbody>
</table>

# Recommended Meningococcal Vaccines in Previously Unimmunized People to Prevent Invasive Meningococcal Disease

<table>
<thead>
<tr>
<th>Population Group</th>
<th>&lt; 2yrs old</th>
<th>2 – 10 yrs old</th>
<th>11 – 18 yrs old</th>
<th>19 – 55 yrs old</th>
</tr>
</thead>
<tbody>
<tr>
<td>General population</td>
<td>NR</td>
<td>NR</td>
<td>MCV4 IM</td>
<td>NR</td>
</tr>
<tr>
<td>Increased Risk: College freshmen, certain travelers, outbreaks, increased susceptibility, military recruits</td>
<td>NR</td>
<td>MCV4 IM or MPSV4 SQ</td>
<td>MCV4 IM (MPSV4 acceptable)</td>
<td>MCV4 IM (MPSV4 acceptable)</td>
</tr>
</tbody>
</table>

MCV4 – tetravalent meningococcal (A, C, Y, W-135) conjugate vaccine  
MPSV4 – tetravalent meningococcal (A, C, Y, W-135) polysaccharide vaccine

**PFV 2009**: single dose ≥ 2yrs old at high risk for disease (outbreak: infants 3mos-2yrs old may be given 2 doses at least 3mos apart; revaccination if w continued risk 3-5 yrs later.

Varicella Zoster (Chickenpox)

- Varicella zoster virus (VZV)
- Member of herpesvirus family
- **Incubation period**: 14 – 16 days (10-21 days)
- **Contagiousness**: 1-2 days before onset of rash to crusting of all lesions

Varicella disease: chickenpox

- Primary infection causes varicella (chickenpox)
- Generalized pruritic vesiculo-papular rash 250-500 lesions in various stages
- Usually accompanied by fever + other systemic symptoms

**Varicella complications**

Majority of complications in otherwise healthy individuals\(^1,2\)

<table>
<thead>
<tr>
<th>Skin/soft tissue/bone/joint infections</th>
<th>Central nervous system complications</th>
<th>Respiratory complications/others</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bacterial superinfections</td>
<td>Acute cerebellar ataxia</td>
<td>Pneumonia</td>
</tr>
<tr>
<td>Osteomyelitis</td>
<td>Encephalitis</td>
<td>Bronchitis</td>
</tr>
<tr>
<td>Necrotising fasciitis</td>
<td>Meningitis</td>
<td>Thrombocytopenia</td>
</tr>
<tr>
<td>Orbital cellulitis</td>
<td>Central facial palsy</td>
<td></td>
</tr>
<tr>
<td>Septic arthritis</td>
<td>Reye’s syndrome</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Guillain-Barré syndrome</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>


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**“Shingles”**

- Reactivates as **herpes zoster**
- Grouped vesicular lesions in 1-3 dermatomes
- Post-herpetic neuralgia in up to 20% of patients ≥70 years of age!

### Diagnostic tests for VZV Infection

<table>
<thead>
<tr>
<th>Test</th>
<th>Specimen</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tissue culture</td>
<td>Vesicular fluid, CSF, biopsy tissue</td>
<td>Limited availability, cost, up to a week for results</td>
</tr>
<tr>
<td>PCR</td>
<td>Vesicular swabs/scrapings, scabs from crusted lesions, biopsy tissue, CSF</td>
<td>Very sensitive, specific for VZV</td>
</tr>
<tr>
<td>DFA</td>
<td>Vesicle scraping, swab of lesion base (must include cells)</td>
<td>Specific for VZV, faster than culture, less sensitive than PCR</td>
</tr>
<tr>
<td>Tzanck smear</td>
<td>Vesicle scraping, swab of lesion base (must include cells)</td>
<td>Not specific for VZV, less sensitive and accurate than DFA</td>
</tr>
<tr>
<td>Serology (IgG)</td>
<td>Acute and convalescent serum for IgG</td>
<td>Specific for VZV, not sensitive to identify vaccine induced immunity</td>
</tr>
<tr>
<td>Capture IgM</td>
<td>Acute serum for IgM</td>
<td>Specific for VZV, inconsistently detected, not routinely reliable</td>
</tr>
</tbody>
</table>


### Varicella Zoster (Chickenpox)

- **Infection control:**
  - **Patients with varicella**
    - Standard precautions
    - Airborne and Contact precautions (minimum 5 days after onset or rash until all lesions crusted)
  - **Exposed patients with no immunity**
    - Airborne and Contact precautions (8 to 21 days until after exposure to index patient)
  - **Immunocompromised patients/disseminated zoster**
    - Airborne and Contact precautions for duration of illness
  - **Immunocompetent with localized zoster**
    - Contact precautions until all lesions are crusted

Varicella Zoster (Chickenpox)

- **Treatment:**
  - Consider: host factors, timeline, extent of infection, initial response to therapy
  - Antiviral drugs: *limited window of opportunity*
  - **Oral Acyclovir**
    - *not recommended routinely in healthy children*
    - Given *within 24 hrs of rash* → modest decrease in ssxs
    - Considered in healthy people at increased risk:
      - > 12 yrs of age
      - Chronic cutaneous or pulmonary disorders
      - Long term salicylate therapy
      - Short, intermittent, or aerosolized steroids
      - Secondary household cases
      - Pregnant women in 2nd/3rd trimester

Varicella Zoster (Chickenpox)

• Treatment:
  – **IV Acyclovir**
    • Immunocompromised patients
    • Chronic corticosteroids
    • Give within 24 hrs of rash onset
  – Other treatments
    • High-dose oral acyclovir, valacyclovir, famcyclovir (selected immunocompromised pts at lower risk)
    • VZIG, IVIG
      – Given shortly after exposure
      – Not effective once disease is established
    • Do not use salicylates!

Varicella Zoster (Chickenpox)

• Care of exposed unimmunized people:
  – **Varicella vaccine** in persons > 12 months old within 3 days (up to 5 days after exposure)
  – **VZIG/IVIG** (up to 4 days after exposure)
    • VZIG: 125 units/10kg IM (max 625 units)
    • IVIG: 400mg/kg IV
    • Depends on:
      – Likelihood of no immunity to varicella
      – Probability that exposure will result in infection
      – Likelihood of complications
  – Prophylactic oral Acyclovir beginning 7 days after exposure

**AAP Red Book: 2009 Report of the Committee on Infectious Diseases 28th ed.**
How effective is Varicella Vaccination as Post Exposure Prophylaxis?

“Effectiveness of Varicella Vaccines as Post Exposure Prophylaxis”

- Brotons M. et al. PIDJ Vol 29, no. 1, 2010
- Prospective Cohort Study
- Varilrix™ (GSK) or Varivax™ (Sanofi Pasteur MSD)
- May 2002 to 2007

- **67 subjects**: 21 pxs < 13 yrs old; 46 pxs ≥ 13 yrs old

- **Effectiveness**:
  - Preventing any type of disease: 62.3%
  - Preventing moderate to severe disease: 79.4%

Varicella Vaccination:

- Live-attenuated monovalent varicella vaccine (VV)
  - 12 months or older
- Quadrivalent measles-mumps-rubella-varicella (MMRV)
  - 12 months to 12 years of age
- Dose: 0.5ml SQ

- Immunogenicity and Effectiveness:
  - Single dose: 70 - 90%
  - 2 doses: approaching 100%
    - Less breakthrough varicella
Varicella Vaccination:

Recommendations:

• 2-dose schedule
  – recommended by AAP, PFV (with PIDSP and PPS)

• 1st reason: to induce protection in children without an adequate response to the 1st dose (not waning immunity)


Varicella Vaccination:

Recommendations:

– Children 12 mos – 12 yrs: 2 doses SQ VV or MMRV
  • 1st dose: 12-15 months old
  • 2nd dose: 4-6 years old
  • Minimum interval: 3 months

– 13 years old or older: 2 doses SQ VV at least 28 days interval

Summary

• Many illnesses caused by infectious agents have associated cutaneous manifestations.
• Diagnosis of infectious exanthems: not impossible
• “Rashes”: offer important clues to the etiology of patient’s illness
• Hallmark of diagnosis: Recognition!
  good history + good physical examination

Thank you!