Bronchiolitis

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Definition

- Acute inflammation of the lower respiratory tract typically leading to distress, expiratory obstruction and wheezing

- Usually infectious in nature, but can result from other forms of lung injury:
  - chemical
  - immunologic
  - other
Pathophysiology

- Increased thickness of airway wall
  - Vascular engorgement
  - Cellular infiltration
  - Mucosal and submucosal edema
- Increased luminal content
  - Increased secretions
  - Rheologic changes in mucus
  - Epithelial sloughing
  - Impaired ciliokinesis
Pathophysiology

• Airway smooth muscle contraction
  • Autonomic dysfunction
  • Mediator (cytokine) release
  • Impairment of epithelial-mediated muscle relaxation (NO)
  • Altered activation characteristics of airway smooth muscle

• All lead to lower airway obstruction and increased airway resistance.
Microbiology

• RSV - far and away most common cause (80%); 95% of children have serologic evidence of infection by age 2

• Parainfluenza types 1, 2 and 3 (25%)

• Influenza A & B (5%)

• Rhinovirus (5%)

• Adenovirus (5%)

• Mycoplasma (5%?)

• Others: Human Metapneumovirus, Bocavirus
Children at High Risk for Severe RSV

Premature birth
- Altered airway anatomy
- Absence of maternal antibody

Chronic Lung Disease
- Bronchial hyper-responsiveness
- Reduced lung capacity

Congenital Heart disease
- Pulmonary vascular hyper-responsiveness
- Pulmonary hypertension
- Increased pulmonary blood flow

Neuromuscular disease
- Decreased respiratory muscle strength and endurance

Immune deficiency
- Decreased host defenses
- Impaired capacity to eliminate virus

Adapted from a presentation by L. Weisman, MD: 1st International Congress RSV, 2002
Other Populations at Risk for Severe RSV

- Infants with Cystic Fibrosis
  - Already have airway inflammation, subtle nutritional deficiencies
  - Study completed 2003
  - Results out this year?

- Native American and Alaskan Native Children
  - Subtle differences in immune function conveying greater risk
  - Generally less optimal living situation
Risk Factors for Hospitalization with RSV
1708 Hospitalized Infants in Rochester, NY

- Prematurity
- Chronic Disease
- Age < 6 wks

1 or more Risk Factors
RSV Bronchiolitis

Normal Lung

RSV-infected Lung

Bronchocentric Infiltrates

Epithelial sloughing with exudates and fibrin
RSV Bronchiolitis

- Peribronchiolar Tissue
- Goblet Cell
- Submucosa
- Blood Vessel
- Smooth Muscle Contraction
- Alveoli
- Ciliated Columnar Epithelium
Budding RSV Virion

Envelope Spikes
G (Attachment)
F (Fusion)

Inner Envelope
M and M2 – Membrane associated (Matrix Proteins)

Nucleocapsid
N (Nucleoprotein)
P (Phosphoprotein)
L (Polymerase)

Nonstructural
NS1 and NS2 – proteins unique to pneumoviruses

Surface of Infected Cells
SH (1A) – small surface protein

Collins, P. Fields Virology. 2nd Ed
Respiratory Syncytial Virus
Clinical Features

• URI prodrome
  • Low grade fever, nasal discharge/congestion

• Signs/symptoms of lower respiratory tract disease
  • Cough, tachypnea, wheeze, hypoxemia

• Apnea may occur in neonates
Typical CXR of RSV Lower Respiratory Tract Infection (LRTI)

Air Trapping
Atelectasis
Streaky Markings
Clinical course

- Incubation period: 2-8 days
- Upper respiratory infection: 1-3 days
- Worsening lower airway disease: 3-5 days
- Full recovery: 2-8 weeks

Swingler et al. 2000
Treatment

• Supportive care - oxygen, fluids
• Bronchodilators - albuterol vs ipratropium vs epinephrine
• Systemic steroids only in severe cases
• Antibiotics - only as indicated
• Ribavirin only in specific instances
  • Immunocompromised infants, children, adults
Prevention of RSV

– Efforts to reduce RSV spread include:
  • Limiting contact with infected people
  • Removal from day-care and group settings
  • Proper hygiene: Frequent hand washing
  • Disinfecting surfaces exposed to infectious secretions

– Despite optimal practices, most children are exposed to RSV by 2 years of age.

– Passive Immunoprophylaxis

RSV Transmission

- RSV is transmitted by droplets, large particles, and fomites.
- RSV can survive for as long as 6 hours on stethoscopes and up to 12 hours on hard, nonporous surfaces.
- Over 50% of medical personnel are infected with RSV when RSV is prevalent in the community.
- Nosocomial infection remains an enormous problem.

The RSV-Asthma Link

- Several prospective studies have shown that RSV bronchiolitis is associated with recurrent wheezing during subsequent years.
- Recurrent wheezing tends to diminish by early adolescence (age 13)
- Conclusion: RSV appears to be linked to recurrent childhood wheezing through early adolescence

The Tucson Children’s Respiratory Study

- 207 children with mild RSV LRTI not hospitalized
- Controls had no LRTI in the first 3 years of life
- Risk for frequent wheeze was still significantly increased at 11 years (p ≤ 0.01)

The Tucson Children’s Respiratory Study
Risk of Subsequent Wheezing After RSV

# Relationship Between RSV Bronchiolitis In Infancy and Recurrent Wheezing During Childhood

<table>
<thead>
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<th>First author</th>
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<tr>
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<tr>
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<td>3</td>
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<td>OSUNDWA</td>
<td>2</td>
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- **<5 yrs**
- **≥5 yrs**

- Favors no association
- OR=1
- Favors association

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May there never develop in me the notion that my education is complete, but give me the strength and leisure and zeal continually to enlarge my knowledge.

Moses Maimonides