Critical Tools for Evaluation and Management of Neonates: From Birth to 28 days

You are working in the emergency department when EMS brings you a critical three-day-old infant. What is your approach to evaluation and management and when should prostaglandin E1 be given to stabilize? This expert will outline the evaluation and management of the “crashing” neonate and highlight strategies to distinguish cardiac from infectious, from metabolic causes.

OBJECTIVES
- Discuss the latest data regarding the approach to congenital anomalies in the neonate including cardiac, hematologic, and endocrinologic inflammatory markers.
- Review the norms of a neonate as well as the abnormal lab values that warrant further evaluation.
- Discuss the febrile neonate based on current literature including the use of non-specific inflammatory markers.

3/23/2015
1:15 PM-1:45 PM
Grand Ballroom
MO-9

DISCLOSURES:
(+) No significant financial relationships to disclose
CRITICAL TOOLS FOR EVALUATION AND MANAGEMENT OF NEONATES: FROM BIRTH TO 28 DAYS

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Things To Talk About

- Bronchiolitis
- Reactive Airway Disease
- Croup
- Soft Tissue Neck Infections
- Pertussis
- Community acquired pneumonia
- Post Influenza Pneumonia
Why Talk About This? (i.e. “I already know this stuff”)

- These are common day to day practice occurrences
- Presentations are changing
- Immunization has created the proverbial “nature abhors a vacuum”
- Caregivers nationwide are lagging behind the data

QUALITY OF CARE FOR COMMON PEDIATRIC RESPIRATORY ILLNESSES IN UNITED STATES EMERGENCY DEPARTMENTS: ANALYSIS OF 2005 NATIONAL HOSPITAL AMBULATORY MEDICAL CARE SURVEY DATA

Pediatrics 2008 122: 1165–1170
Objective

- To measure US emergency department performance in the pediatric care of asthma, bronchiolitis, and croup, by using systematically developed quality indicators

Methods

Data on visits to EDs by children

| 1 - 19 years with moderate/severe asthma | 3 mos - 2 yrs with bronchiolitis | 3 mos to 3 yrs with croup |
## Results

<table>
<thead>
<tr>
<th>Treatment</th>
<th>Description</th>
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</thead>
<tbody>
<tr>
<td>Corticosteroids</td>
<td>69% of the 405,000 visits for moderate/severe asthma</td>
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<tr>
<td></td>
<td>31% of the estimated 317,000 annual croup visits</td>
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<tr>
<td>Antibiotics</td>
<td>53% of the estimated 228,000 annual visits for bronchiolitis</td>
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<tr>
<td>Radiographs</td>
<td>72% of bronchiolitis visits</td>
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<tr>
<td></td>
<td>32% of croup visits</td>
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## Conclusions

- Physicians treating children with asthma, bronchiolitis, and croup in US emergency departments are underusing known effective treatments and overusing ineffective or unproven therapies and diagnostic tests
Case: “Don’t You Just Love Winter?”

A 3 month old presents with wheezing for 2 days. Preceded by a URI, his feeding has decreased and his cough interrupts sleep. TMAX at home 38. Normal neonatal history. Immunized.
Exam

Temp 38.5, RR 60, OSAT 94% in Room Air
Mild rhinorrhea, air entry good, wheezing in all fields
Hydrated, feeds well
No grunting or retractions
This is a classic case of Bronchiolitis

What should be done diagnostically?

- RSV wash
  - may be necessary for bed placement
  - not all bronchiolitis is RSV (metapneumovirus)
  - yet may decrease likelihood of bacteremia (but not UTI)
Objective

- The risk of serious bacterial infection (SBI) in febrile infants who are classified as low risk (LR) or high risk (HR) by the Rochester criteria has been established.
- LR infants average a 1.4% occurrence of SBI, whereas HR infants have an occurrence of 21%.
- The occurrence of SBI in Rochester LR or HR infants with confirmed viral infections is unknown.
- The objective of this study was to determine the occurrence of SBI in Rochester LR and HR infants with and without viral infections.
Methods

• All febrile infants 90 days or younger
• Infants were classified as Rochester LR or HR, and discharge diagnoses were collected
• Viral testing for enteroviruses, respiratory viruses, rotavirus, and herpesvirus was performed as indicated by study protocol, clinical presentation, and season of the year
• Results of all bacterial cultures were reviewed

Results

• By the Rochester criteria, 456 (33%) infants were classified as LR and 922 (67%) infants as HR
• For infants with viral infections, the occurrence of SBI was significantly lower than in infants without a viral infection (4.2% vs 12.3%)
• Rochester HR virus-positive (HR+) infants had significantly fewer bacterial infections than HR virus-negative (HR-) infants (5.5% vs 16.7%)
Conclusions

- Febrile infants with confirmed viral infections are at lower risk for SBI than those in whom a viral infection is not identified
- Viral diagnostic data can positively contribute to the management of febrile infants, especially those who are classified as HR

What should be done diagnostically?

- CXR
  - All first time wheezers (will be hyperinflated +/- focal disease)
What can you offer therapeutically?

- Beta 2 Agonists
  - Clinical trials, meta-analyses & systematic reviews (2000-present) showed some differences in short term benefits (oxygen, RR) yet *no difference in clinically meaningful outcomes (admission, length of stay)*
  - yet *SOME WILL RESPOND*----“no one ever died from one albuterol treatment”

What can you offer therapeutically?

- Corticosteroids
  - 2004 Cochrane Review
    - 13 trials (3 outpatient), 1200 children
    - *No difference in admission rates, no benefits compared to placebo*
  - PECARN multicenter trial
    - Compared Dexamethasone and placebo in ED patients with bronchiolitis
    - No difference in admission at 4 hours
    - USE ALBUTEROL RESPONSE AS A GUIDELINE FOR USE
Who should be admitted?

- Hypoxemics and poor feeders
- Infants born at less than 34 weeks
- Comorbid issues (heart disease)
- Atelectasis
- Less than 2 months, apnea is possible

Current Research Data (6 studies) NOT HELPFUL

Case: “Beware the First Week of School”
**History**

A 5 year old presents with a 3 day history of cough, worse with activity

No history of sick contacts or fever

“No one smokes inside the house.”

Strong family history of asthma

**Exam**

Afebrile, normal RR, no work of breathing

OSAT 94% in Room Air

Coughing during exam

Prolonged expiratory phase, questionable scant wheeze
What can be done diagnostically?

• CXR
  • in RAD will show hyperinflation AND rule out odd etiologies in “first time wheezers”

Other Causes of Wheezing

Aspirated Peanut in Left Mainstem Bronchus
Other Causes of Wheezing

- Coin in Esophagus
- Congenital Lobar Emphysema

What can be done diagnostically?

- Trial of a bronchodilator
  - DEFINITELY indicated since the first symptom of RAD is cough, not wheezing
  - in older kids, Peak Flow measurements pre and post aerosols will often seal the deal
  - many of these chronic cough kids get labeled as “bronchitis”, not really a pediatric disease, and end up on antibiotics ("the road to hell is paved with Zithromax")
What can be done therapeutically?

- **Albuterol and Atrovent**
  - Indicated, often X3
  - Use *spacers* if motor competent

- **Steroids**
  - give them EARLY, often for 3-5 days, may use Decadron IM
  - Oral as effective as IV

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What can be done therapeutically?

- **Levalbuterol**
  - Is it really superior?
    - Carl et al 2003: 547 children 1-18 - Admission Rates – 45% (albuterol) vs. 36% (levalbuterol)---*No difference in length of stay or other outcomes*
  - What about cost?
    - Compared to albuterol
      - 2 X unit dose
      - 5 X multidose vial
    - Weigh against cost of admission
# Mechanism of Action - Albuterol

- Stimulates adenyl cyclase, the enzyme that catalyzes the **formation of cyclic-3',5'-adenosine monophosphate (cAMP)** from adenosine triphosphate (ATP)

- β2-adrenergic receptors are the predominant receptors in bronchial smooth muscle

- Albuterol has been shown in most controlled clinical trials to have more effect on the respiratory tract, in the form of bronchial smooth muscle relaxation, than isoproterenol at comparable doses while producing fewer cardiovascular effects

# Mechanism of Action - Ipratropium

- **Blocks muscarinic acetylcholine receptors**, promotes the degradation of cyclic GMP

- Results in decreased contractility of smooth muscle in the lung, *inhibiting bronchoconstriction and mucus secretion*

- It is a nonselective muscarinic antagonist and does not diffuse into the blood, which *prevents systemic side effects*

- Derivative of atropine but does not cross the blood-brain-barrier, which prevents central side effects (anticholinergic syndrome)

- Ipratropium is not considered a short-acting bronchodilator and should never be used in place of albuterol as a rescue medication
Mechanism of Action - Steroids

Mechanism of Action - Magnesium

- Lots of mixed result studies but everybody uses them
- MOA multifactorial
- **Inhibits smooth muscle contraction**
- **Inhibits acetyl choline release**
- **May potentiate Beta agonist effects**

*Fawcett WJ. Br J Anaesth 1999: 83: 3023-320*
Case: “Is This a Waiting Room or a Kennel?”

History/Exam

A 3 year old is sent in by his pediatrician at 2 AM after listening to him coughing by phone.

The child had a URI for 2 days and then began to cough, with progression to hoarseness and what sounds like stridor.

In the ED he is febrile (39), running around the room without stridor at rest.

Not drooling. Lungs clear.
What can be done diagnostically?

• CXR
  • Just say NO----

• Quick recheck of immunization status----epiglottitis is still possible in this group (crunchies, Amish, Menonites)

What can be done therapeutically?

• Mist therapy
  • Doesn’t work!
• Corticosteroids
  • Effective in moderate to severe croup---**PO/IM superior to nebulized**
  • Dexamethasone (0.15 - 0.6 mg/kg) PO/IM
• Aerosolized vапonephrine
  • No rebound---reserve for kids with stridor at rest---if clinically fine after 2 hours may send home---rebound is unlikely
Croup Summary

No xray

No mist

Say yes to Decadron

Stridor at rest
- Administer racemic vaponephrine
- Observe 2 hours
- If OK then discharge
- If stridor recurs, admit

“JUST ANOTHER SORE THROAT?”
Case

A 5 year old is referred from a private office for evaluation of fever, sore throat and a stiff neck

The PMD feels “he might need a tap”

He has been sick for 3 days with a URI (runny nose, mild cough), no wheezing or respiratory distress

He will drink liquids but has refused solid food for one day

Case

His temperature has been 38.5°C at home

He has no eye or ear pain, no headache, abdominal complaints or rash

No sick contacts

Insignificant PMH (immunized)
Case PE

A non toxic 5 yr old with a rectal temperature of 38.8C

He is able to lie down

Pertinent findings include symmetrical, non swollen, red tonsils and a mild torticollis

There is no significant lymphadenopathy

Kernig and Brudzinski signs are absent

Problem List

- Sore throat
- Fever
- Mild torticollis
- Tonsillar erythema
Workup Options

Sore throat and fever
- Throat culture
- Antibiotics
- Discharge

Torticollis
- NSAIDs
- Observation
- Radiographs?

Sore Throat: Recognizable Clinical Patterns

- Erythema, exudate, tender nodes
  - GABHS
  - EBV

- Hot potato voice, tonsillar asymmetry
  - PTA

- Dysphagia, drooling, toxicity
  - Epiglottitis
Tonsillitis/Peritonsillar Abscess

What About Fever, Sore Throat and Torticollis?

- You must consider ALL superficial and deep neck structures
- Your PE may not tell the whole story
- **Imaging** is indicated
  - Skip “soft tissue neck” radiographs
  - CT scanning with enhancement is always indicated
Why The Neck Is Not Your Friend I

Why The Neck Is Not Your Friend II
Why The Neck Is Not Your Friend III

Why The Neck Is Not Your Friend IV
The Worst Case Scenario

Lemierre’s Syndrome

Back To Our Patient

WBC of 18K with a left shift

A spinal tap was unremarkable

A CT (with enhancement) of his neck demonstrated a 2 cm parapharyngeal abscess
Back To Our Patient

ENT was consulted, he was placed on IV antibiotics, and observed overnight

His mass resolved over 3 days and he went home in good condition

Neither the blood culture or throat culture grew any organisms

CT Neck

[CT scan image showing airway and abscess]
Take Home Message

- Soft tissue neck infections in infants and children are on the rise
- There is often an element of torticollis
- Routine PE may be unrewarding
- Enhanced CT scanning will often diagnose
  - RPA
  - Parapharyngeal space infections
  - Lymphatic infections of the neck

Case Five: “That’s a Heck of a Cough”
History

A 6 month old presents with cough for 7 days

What began as a URI has progressed to bursts of coughing followed by post tussive emesis

The cough is incessant

Mild fever

No significant PMH, immunized for age

Exam

On exam afebrile with normal OSAT and VS

Subconjunctival hemorrhages and facial petechiae

Lungs clear

Attempts to examine the oropharynx are met with profound coughing with desaturations
PERTUSSIS

Pertussis

Infection secondary to inhalation of B. pertussis

Duration of illness: 6-8 weeks

Three stages of symptomatology:

- Catarrhal
- Paroxysmal
- Convalescent
Catarrhal Stage

ESSENTIALLY RESEMBLES A SIMPLE COLD

- Rhinorrhea, lacrimation
- Mild cough, conjunctival injection
- Low grade fever
- Looks indistinguishable from a common URI

Paroxysmal Stage (2-4 Weeks)

- Repetitive paroxysms - forceful coughs during a single expiration, followed by a massive inspiratory effort (whoop)
- Cyanosis, bulging eyes, tongue protrusion, salivation, lacrimation, neck vein distention
- Post-tussive emesis commonly occurs
- Attacks triggered by yawning, eating, drinking
- Infants lack the whoop
Convalescent Stage (1-2 Weeks)

- Less frequent paroxysms, decreasing in severity
- The cough may persist for months

Complications

- Apnea
- Pneumonia
- Subarachnoid/intraventricular/subconjunctival hemorrhages
- Umbilical/inguinal hernias
Clues to the Diagnosis

- Witnessing a paroxysm
- High WBC (20-50,000) with marked lymphs (70%) during the paroxysmal stage
- Immunofluorescent antibody (IFA) staining of nasopharyngeal secretions/PCR testing

Treatment

- Oxygen during paroxysms
- Avoid suctioning or any form of oral stimulation
- Erythromycin (50 mg/kg/day) eliminates organisms from the nasopharynx in 3-4 days (treat the household)
- Antibiotic therapy does NOT shorten the paroxysmal stage
Disposition

- Children under 6 months
  - admit for observation, apnea monitoring
- No fixed current guidelines for the older patient

What can be done therapeutically?

- Avoid any form of oral stimulation
- Provide supplemental oxygen
  - Admission
- Treat the child and household contacts with a *Macrolide*
- Make sure you’ve received a *pertussis immunization*
EXECUTIVE SUMMARY: THE MANAGEMENT OF COMMUNITY-ACQUIRED PNEUMONIA IN INFANTS AND CHILDREN OLDER THAN 3 MONTHS OF AGE: CLINICAL PRACTICE GUIDELINES BY THE PEDIATRIC INFECTIOUS DISEASES SOCIETY AND THE INFECTIOUS DISEASES SOCIETY OF AMERICA

CID 2011:53 (1 October)
Who Should Be Hospitalized?

- Children and infants who have respiratory distress and hypoxemia
- Infants less than 3–6 months of age with suspected bacterial CAP
- Children and infants with suspected or documented CAP caused by a pathogen with increased virulence, such as community-associated methicillin-resistant Staphylococcus aureus (CA-MRSA)

Diagnostic Testing

- Blood cultures should not be routinely performed in nontoxic, fully immunized children with CAP managed in the outpatient setting
- Sensitive and specific tests for the rapid diagnosis of influenza virus and other respiratory viruses should be used in the evaluation of children with CAP
- Antibacterial therapy is not necessary for children, either outpatients or inpatients, with a positive test for influenza virus in the absence of clinical, laboratory, or radiographic findings that suggest bacterial coinfection
Diagnostic Testing

- *Routine measurement of the complete blood cell count is not necessary in all children with suspected CAP managed in the outpatient setting,* but in those with more serious disease it may provide useful information for clinical management in the context of the clinical examination and other laboratory and imaging studies.

- *Acute-phase reactants,* such as the erythrocyte sedimentation rate (ESR), C-reactive protein (CRP) concentration, or serum procalcitonin concentration, *cannot be used as the sole determinant to distinguish between viral and bacterial causes of CAP.*

Diagnostic Testing

- *Routine chest radiographs are not necessary* for the confirmation of suspected CAP in patients well enough to be treated in the outpatient setting (after evaluation in the office, clinic, or emergency department setting).
Anti-Infective Treatment

- Antimicrobial therapy is not routinely required for preschool-aged children with CAP, because viral pathogens are responsible for the great majority of clinical disease.

- **Amoxicillin** should be used as first-line therapy for previously healthy, appropriately immunized infants and preschool children with mild to moderate CAP suspected to be of bacterial origin.

- **Macrolide** antibiotics should be prescribed for treatment of children (primarily school-aged children and adolescents) evaluated in an outpatient setting with findings compatible with CAP caused by atypical pathogens.

Anti-Infective Treatment

- Treatment courses of 10 days have been best studied, although shorter courses may be just as effective, particularly for more mild disease managed on an outpatient basis.
In Summary

- Therapeutic interventions in RSV may be effective and worthwhile
- Standardized approaches to RAD will improve outcomes
- Steroids have an EARLY role in both croup and RAD
- Soft tissue neck infections are on the rise
- Pertussis surveillance is mandatory
- Community acquired pneumonia has standards of care
- Post influenza Staphylococcal pneumonia should always be suspected in season

Thank You!