Antibiotic Stewardship in the NICU: An Overview

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What is Antibiotic Stewardship?

Definition

— Coordinated interventions designed to improve and measure the appropriate use of antibiotics
Antibiotic Stewardship Overview Topics

1. The Microbial World
2. Bacteria are bad
3. Antibiotics are good
4. Bacteria are good
5. Antibiotics are bad
6. The need for a better balance
1. We’re Just a Little Part of a Big World
Most of Its Inhabitants are Microbes
2. Bacteria are Bad
We’re Understandably Afraid of them

Necrotizing Enterocolitis

Pneumonia

Sepsis
3. Antibiotics are good
Have Saved Many Lives (50 fold drop)

FIGURE 1. Crude death rate for infectious diseases—United States, 1900-1996
[Adapted by Rear Admiral Dr. Patrick O’Carroll, Regional Health Administrator; U.S. Public Health Service Region X]

Crude death rate* for infectious diseases — United States, 1900–1996†

Rate


Influenza Pandemic
First Continuous Municipal Use of Chlorine in Water in United States
Last Human-to-Human Transmission of Smallpox
First Use of Penicillin
Salk Vaccine Introduced
Pneumonia Passed into Vaccination Assistance Act

*Per 100,000 population per year.
But The Drop in Infection Is Only Partly From Antibiotics

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Pre-antibiotic era   Antibiotic era
Current Imbalance
Low Neonatal Infection rate, High Antibiotic Use

Blood Cultures: 15%
Antibiotics: 10%

Early Onset Sepsis incidence: <0.05%
Others Side Effects of Imbalance
Maternal Complications from NICU

- Disruption of mother-baby bonding
- Disruption of breast feeding initiation
- Elevated maternal postpartum depression risk
- Vulnerable child syndrome risk

Lu, J Gastroenterol 2015
4. Bacteria are good
Our (Internal) Microbiome Promotes Health

• Examples
  • Suppress pathogenic bacteria
  • Encourage immunological homeostasis
  • Support GI physiology
5. Antibiotics are Bad
They Disrupt the Microbiome, Causing Harm

Fig. 1 Diseases associated with an aberrant neonatal gut microbiota

Lu, J Gastroenterol 2015
Antibiotics are Bad
They Cause Antibiotic Resistance

Resistant Strains Spread Rapidly

% Incidence

Source: Centers for Disease Control and Prevention

MRSA = Methicillin-resistant *Staphylococcus Aureus*  
VRE = Vancomycin-resistant Enterococci  
FQRP = Floroquinolone-resistant *Pseudomonas aeruginosa*

Pssst! Hey kid, stick this in your genome and antibiotics can’t even touch you!
New Antibiotic Development Can’t Keep Up
Development Slowing, Deaths Rising

10 fold drop in new antibiotics since 1980s

10 fold increase in deaths from antibiotic resistance by 2050?
Antibiotic Stewardship
Striking a Better Balance of Benefit and Risk
Antibiotic Stewardship
It Can Work

- Meta-analysis (Lancet 2016)
  - N=145 studies

<table>
<thead>
<tr>
<th>Intervention</th>
<th>Mortality (RR)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Guideline Driven Choice of Initial Antibiotics</td>
<td>35% less</td>
</tr>
<tr>
<td>Guideline driven de-escalation of antibiotics</td>
<td>64% less</td>
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Antibiotic Stewardship
Huge Area of Interest

Google

antibiotic stewardship

About 421,000 results (0.40 seconds)
Antibiotic Stewardship
Legally Mandated

- California
  - Senate Bill 739 (2006)
  - Senate Bill 1311

- Federal
  - CMS Executive Order (2015)
Antibiotic Stewardship
Demonstrated Deficiency in California NICUs

- Schulman 2015
  - N=127 California NICUs
  - Measure:
    - % patient days with one or more iv antibiotics
  - Results
    - 2% to 97%!
  - Unrelated to:
    - Proven infection
    - NICU level
    - NEC
    - Surgical volume
    - Mortality
Antibiotic Stewardship Overview

Thanks!

- Thanks to
  - Nami Jhaveri, MD
  - Carol Glaser, MD
  - My colleagues in CPQCC and KP
Antibiotic Stewardship
Striking a Better Balance of Benefit and Risk

- M Microbiology guides therapy wherever possible
- I Indications should be evidence based
- N Narrowest spectrum required
- D Dosage appropriate to the site and type of infection
- M Minimise duration of therapy
- E Ensure monotherapy in most situations