PEDIATRIC PHARMACOLOGY 
UPDATES FOR 2013

Renee Fife, MSN, CPN, CPNP
Assistant Clinical Professor
Purdue University Calumet

fifer@purduecal.edu
Today’s Topics and Objectives

- Meningococcal vaccine
  - Define the current ACIP recommendations for the use of the meningococcal vaccine
- HPV vaccine
  - Recognize the implications of using the HPV vaccine in the male teenager population
- Infant Formula
  - Explain the principles that should be used when prescribing infant formula
- GI motility issues
  - Identify appropriate pharmacologic interventions for gastrointestinal issues related to motility
Bacterial meningitis affects about 2,600 persons annually in the US

- 10-15% are fatal within 24-48 hours of symptom onset
- Up to 20% of survivors suffer neurological sequelae
- High risk populations:
  - Under 1 year of age
  - Immune suppression, any age
  - Travel to endemic areas of the world
  - College students in dormitories

About 170,000 deaths worldwide

Major causes:

- *Haemophilus influenzae* type b
- *Neisseria meningitidis*
  - 12 serotypes (varies by geography)

WHO, 2011
Meningococcal Prevention

- Hib vaccine, four shot series
  - 2, 4, 6, and 12-15 months
- Individual injection
  - ActHIB: Sanofi, licensed 1993
  - HibTITER: Wyeth, now Nuron Biotech, licensed 1990
  - PedvaxHIB: Merck, licensed 1989
  - Hiberix (booster): GlaxoSmithKline, licensed 2009
- Part of a combination vaccine
  - Pentacel (DTaP-IPV and Hib): Sanofi, licensed 2008
  - Comvax (HBV-Hib): Merck, licensed 1996
  - MenHibrix (Meningococcal & Hib): GlaxoSmithKline, licensed 2012
Meningococcal Prevention

- Meningococcal vaccine, 2 shot series
  - First dose at 11-12 years with a booster at 16 years
  - Little evidence of protection beyond three years

- Meningococcal vaccine for “at risk” population
  - May start as early as 9 months, per CDC 2012

- Individual injection
  - **Menactra** (MCV4): Sanofi, licensed in 2005 (2 - 55yrs)
    - April 2011 gave approval for use as young as 9 mos
  - **Menveo** (MCV4): Novartis, licensed 2010 (2 - 55yrs)

- Part of a Combination injection
  - **MenHibrix** (Meningococcal & Hib): GlaxoSmithKline, licensed 2012 for use as early as 6 weeks
New Recommendations for Meningococcal Prevention

- Advisory Committee on Immunization Practices (ACIP), 15 member panel of immunization experts
- October 24, 2012 meeting
  - Evaluated need for routine infant immunization
  - PRO
    - Protect every child against meningitis
  - CON
    - 50-60% of infant disease is serotype B and there is no current effective vaccine for B for the US population
      - At week 41 of 2012, only 7 cases and 2 deaths were attributed to serotype C and Y in the 6-59 month age group
    - Annual incidence rate in US is at an all-time low
      - One fifth of what it was in the early 1980’s
      - Would need to vaccinate 642,000 to prevent one death (cost)
New Recommendations for Meningococcal Prevention

- **Final Decision:**
  - Vote was impressive at 13-1 with 1 abstention
  - Infants at increased risk for meningococcal disease should receive 4 doses of the Hib-MenCY-TT vaccine
  - Data do not currently support routine infant meningococcal vaccination

- **The Increased Risk population includes**
  - Persistent complement pathway deficiencies
  - Anatomic or functional asplenia
  - Infants in communities with outbreaks of C and Y serogroup meningococcal disease
  - Overall, this should be about 5,000 infants annually
FDA approved a combination vaccine
- Safety was evaluated in ~7,500 infants/toddlers
- Adverse reactions were the same as other vaccines
  - Injection site reaction, pain and fever

MenHibrix (GlaxoSmithKline)
- Meningitis C/Y-Hib
- Four dose series
  - 2 months (but as early as 6 weeks)
  - 4 months
  - 6 months
  - 12-15 months (but as late as 18 months)

Be aware that the total number of shots will go up per visit unless GSK products are used
<table>
<thead>
<tr>
<th>Vaccine Needed</th>
<th>2 month product</th>
<th>4 month product</th>
<th>6 month product</th>
<th>12-15 month product</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hepatitis B</td>
<td>Pediarix</td>
<td>Pediarix</td>
<td>Pediarix</td>
<td>Pediarix</td>
</tr>
<tr>
<td>Rotavirus</td>
<td>Rotarix</td>
<td>Rotarix</td>
<td>Rotarix</td>
<td>Rotarix</td>
</tr>
<tr>
<td>Diptheria, tetanus, pertussis (DTaP)</td>
<td>Pediarix</td>
<td>Pediarix</td>
<td>Pediarix</td>
<td>DTaP</td>
</tr>
<tr>
<td>H. influenza type b (Hib)</td>
<td>Menhibrix</td>
<td>Menhibrix</td>
<td>Menhibrix</td>
<td>Hiberix (booster)</td>
</tr>
<tr>
<td>Pneumococcal</td>
<td>Prevnar 13</td>
<td>Prevnar 13</td>
<td>Prevnar 13</td>
<td>Prevnar 13</td>
</tr>
<tr>
<td>Inactivated poliovirus</td>
<td>Pediarix</td>
<td>Pediarix</td>
<td>Pediarix</td>
<td></td>
</tr>
<tr>
<td>Influenza</td>
<td></td>
<td></td>
<td>TIV</td>
<td>TIV (at least 4 wks after 1st)</td>
</tr>
<tr>
<td>Measles, Mumps, Rubella</td>
<td></td>
<td></td>
<td></td>
<td>ProQuad</td>
</tr>
<tr>
<td>Varicella</td>
<td></td>
<td></td>
<td></td>
<td>ProQuad</td>
</tr>
<tr>
<td>Meningococcal</td>
<td>Menhibrix</td>
<td>Menhibrix</td>
<td>Menhibrix</td>
<td></td>
</tr>
<tr>
<td>Total # injections</td>
<td>3, possibly 4</td>
<td>3, possibly 4</td>
<td>4, possibly 5</td>
<td>4, possibly 5</td>
</tr>
</tbody>
</table>

Pediarix: DTaP/IPV/Hep B
Rotarix: RV only**
Prevnar 13: pneumococcal only
TIV: trivalent inactivated influenza
ProQuad: MMR plus varicella
Can your clinic obtain the “right” combination products?
- Comvax: Hep B and Hib (Merck)
- Pediarix: DTaP/IPV/Hep B (GSK)
- Pentacel: DTaP/ IPV/ Hib (Sanofi)
- QuadPro: MMR and Varicella (Merck)

Do you recommend a 9 month visit, which could assist to make the number of injections more manageable

Vaccines for Children (VFC) approved all the previously mentioned vaccines, but cannot guarantee the specific combination products
Final Comment on MenHibrix

- Since it has not received endorsement for universal use by ACIP / AAP / AAFP, it may not be available within the Vaccines for Children free program
- Commercial insurance may only cover it for the endorsed, high risk category
- But, it is a licensed, safe and effective vaccine
- If a parent wants the vaccine for their healthy infant, it may be out-of-pocket
  - Is this creating a two-tiered level of care?
  - Will your office stock it?
Human Papillomavirus Vaccine (HPV)

- Available products are
  - Gardasil (HPV4: types 6, 11, 16 and 18) by Merck
    - Females: help prevent cancer of the cervix, vagina, and vulva; genital warts, and anal cancer
    - Males: help prevent genital warts and anal cancer
  - Cervarix (HPV2: types 16 and 18) by GSK
    - Females only because it helps to prevent cervical cancer only
  - Both are a 3 dose series
    - At 0, then 1-2 months later, then 6 months after the first
    - Best to use the same product throughout the series
  - Ages 9-18 years for both sexes
    - Best to administer BEFORE becoming sexually active
Use only the quadrivalent vaccine (Gardasil)
- Types 6 and 11 are responsible for genital warts and anal cancer

Challenges
- Requires two additional appointments
  - This age group typically doesn't make that many visits to their health care provider
  - Is it possible to have just a “vaccination” visit?
- Convincing males and their parents
  - Discuss openly and honestly on two areas
    - Their personal health
    - The health of their partner/future partner
Serious Talk About Genital Warts

- Diagnosis of genital warts is usually made by visual inspection but may need to be confirmed by biopsy
  - Generally found under the foreskin of the uncircumcised penis, and on the shaft of the circumcised penis, anus and scrotum
- If left untreated, visible genital warts can resolve on their own, remain unchanged, or increase in size / number
- Available therapies for genital warts likely reduce, but probably do not eradicate, HPV infection
- Treatment is generally a topical product and can be patient-applied or provider-applied according to the product
  - To be sure that patient-applied modalities are effective, patients must be capable of identifying and reaching all genital warts
- Pictures are available at http://www.cdc.gov/std/treatment/2010/genital-warts.htm

Let’s move on to a more pleasant topic……………………..
Common Issues with Formula

- “I think my baby is allergic to milk”
- “The formula makes her spit up”
- “Is soy formula healthier than regular?”
- “The formula makes her constipated”
- “My breast milk isn’t enough—what formula should I add?”
Breast Milk Remains the Preferred Diet

- Offers optimal protein, carbohydrates, and fats
  - Will need to supplement with Vit D 400IU/day
    - This may undermine the “perfect food source” notion so present it carefully
- Provides a bonding experience
- Has immunologic properties (IgG, IgA, IgM, IgD)
  - Decreases incidence of diarrheal and respiratory illnesses and AOM
  - Reduced incidence of atopic/allergic problems
When Should Formula be Prescribed?

- Mother chooses not to breastfeed, despite counseling and education
- Mother is unable
  - Adoption, lactation failure, contraindication
- Infant requires special formula
  - Inborn errors of metabolism
  - Premature/ill infant requires increased calories
- Poor weight gain despite an adequate trial of breastfeeding
  - FTT
If formula is to be used, PRESCRIBE a feeding plan

- Give it the same attention that you would if you were prescribing medication
- How to choose the formula?
### What Do the Letters Mean on Formulas?

<table>
<thead>
<tr>
<th>Abbreviation</th>
<th>Meaning</th>
</tr>
</thead>
<tbody>
<tr>
<td>CM</td>
<td>Cow’s Milk</td>
</tr>
<tr>
<td>LCPUFA</td>
<td>Long chain polyunsaturated fatty acids</td>
</tr>
<tr>
<td>DHA (type of LCPUFA)</td>
<td>Docosahexaenoic acid</td>
</tr>
<tr>
<td>ARA/AHA (Type of LCPUFA)</td>
<td>Arachidonic acid</td>
</tr>
<tr>
<td>MCT</td>
<td>Medium-chain tryglycerides</td>
</tr>
<tr>
<td>PHF</td>
<td>Partially hydrolyzed formula (protein component)</td>
</tr>
<tr>
<td>EHF</td>
<td>Extensively hydrolyzed formula (protein component)</td>
</tr>
</tbody>
</table>
Three major categories of formula
1. Cow milk based
2. Soy milk based
3. Specialty or Therapeutic

Basic Components of Formula
- Protein
- Carbohydrate
- Fat
- Additional components

Standard formula is
- 20 kcal per ounce
- Iron fortified (12mg/quart)
  - “low” iron formula is not endorsed by the AAP
Protein source: Whey and Casein

- Whey is easy to digest while casein is slower to digest

<table>
<thead>
<tr>
<th>Source</th>
<th>Whey component</th>
<th>Casein Component</th>
</tr>
</thead>
<tbody>
<tr>
<td>Breast milk*</td>
<td>70</td>
<td>30</td>
</tr>
<tr>
<td>Whole milk</td>
<td>18</td>
<td>82</td>
</tr>
<tr>
<td>Cow’s Milk formula</td>
<td>60</td>
<td>40</td>
</tr>
<tr>
<td>“Newborn”</td>
<td>80</td>
<td>20</td>
</tr>
<tr>
<td>Carnation Good Start</td>
<td>100</td>
<td>0</td>
</tr>
</tbody>
</table>

*changes over time to meet the infant’s needs
- 90:10 in first few days after delivery
- 50:50 by 8 mos
Allergy to Proteins

- True cow’s milk protein allergy is rare, less than 4%
  - Hydrolyzing the protein can decrease the problem
    - Extensively hydrolyzed CM protein is considered to be Hypoallergenic
  - Amino Acid Formula is for severe protein hypersensitivity
- Soy protein is NOT hypoallergenic
  - Should not be used if a protein allergy is suspected
- Breast milk is already Hypoallergenic
Lactose → lactase → glucose and galactose

- Lactose intolerance is rarely seen under 1 year of age (but is over diagnosed)
  - Lactase levels are highest in infancy
  - More common onset is ages 5yrs-15yrs
  - Lactose intolerance occurs when small intestine does not make enough of the enzyme lactase
    - S/S: abdominal pain, diarrhea and flatulence

- Lactose promotes healthy gut colonization
  - Lactose-free formulas should ONLY be used with true diagnosis of lactase deficiency
Lactose is the primary carbohydrate in Breast milk and most Cow’s milk formulas
- Breast milk = 42%
- Cow milk formula = 30%

Sucrose or Cornstarch hydrolysate is the carbohydrate source in Soy formula
- If truly lactose intolerant, then soy formula is prescribed
- Soy is also used if infant has galactosemia

Sucrose → sucrase → glucose and fructose
Fats in Breast Milk and Cow’s Milk Formula

- Majority of calories come from fat
- Cow’s milk butterfat is replaced with a vegetable fat blend
- LCPUFA are linked to visual and neurological development
  - Early studies showed mixed results
  - Latest studies with higher doses show benefit

<table>
<thead>
<tr>
<th></th>
<th>Breast Milk</th>
<th>Formula (in general)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Calories from fat</td>
<td>50%</td>
<td>40-50%</td>
</tr>
<tr>
<td>LCPUFA: DHA</td>
<td>0.32%</td>
<td>0.15-0.32%*</td>
</tr>
<tr>
<td>LCPUFA: ARA</td>
<td>0.47%</td>
<td>0.4-0.64%*</td>
</tr>
</tbody>
</table>

*DHA and ARA were added ~ 2002
- Vitamin D
- Pre and Probiotics
  - Intestinal flora of breastfed babies is unique
  - Added to formula to try to create a similar flora

<table>
<thead>
<tr>
<th>Prebiotics</th>
<th>Probiotics</th>
</tr>
</thead>
<tbody>
<tr>
<td>Non-digestible carbohydrates</td>
<td>Live organisms</td>
</tr>
<tr>
<td>Support growth of certain bacteria</td>
<td>Colonization of colon with beneficial organisms</td>
</tr>
<tr>
<td>Increased levels of lactobacilli</td>
<td>Decreased atopy</td>
</tr>
<tr>
<td>bifidobacteria</td>
<td></td>
</tr>
<tr>
<td>Decreased respiratory and GI</td>
<td>Decreased Necrotizing enterocolitis in premies</td>
</tr>
<tr>
<td>infections</td>
<td></td>
</tr>
</tbody>
</table>

(Martinez and Ballew, 2011)
How to Approach the Parents of Full Term, Healthy Infants

“BM is best, and I recommend it wholeheartedly. If you choose formula, any cow’s milk formula is fine and they are all regulated by the FDA”

“BUT if your formula is causing problems, CALL ME before changing to another brand/type”

Some Standard Cow’s Milk Formulas

- Enfamil Premium (formerly Lipil)
  - More Vit D and 80:20 ratio
  - For the first 4 weeks
- Enfamil Premium Newborn
- Similac Advance
- Parent’s Choice Advantage
  - Reduced lactose
# Modified Cow’s Milk Formulas

<table>
<thead>
<tr>
<th>Formula</th>
<th>Whey: Casein</th>
<th>Hydrolyzed Proteins</th>
<th>Additives</th>
<th>Lactose</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>Enfamil Gentlease</td>
<td>60:40</td>
<td>Partially (PHF)</td>
<td>DHA/ARA Prebiotic</td>
<td>reduced</td>
<td></td>
</tr>
<tr>
<td>Parent’s Choice Gentle</td>
<td>60:40</td>
<td>Partially (PHF)</td>
<td>DHA/ARA prebiotic</td>
<td>reduced</td>
<td></td>
</tr>
<tr>
<td>Carnation Good Start Gentle Plus</td>
<td>100:0</td>
<td>none</td>
<td></td>
<td>reduced</td>
<td>Good for constipation</td>
</tr>
<tr>
<td>Carnation Good Start Gentle Protect Plus</td>
<td>100:0</td>
<td>none</td>
<td>Probiotics</td>
<td>reduced</td>
<td>May spit up more</td>
</tr>
</tbody>
</table>
Special Formulas

- When there is a True Medical Problem
  - Lactose Free Formulas
  - Soy Formulas
  - Anti-reflux Formulas
  - Hypoallergenic Formulas (extensively hydrolyzed)
  - Amino Acid Based Formulas
  - Formulas for Premature Infants
    - Will not cover today due to the complexity
    - Should have been seen by dietitian before discharge
    - Often getting formula >20 kcal per ounce
Formulas Marketed for Lactose “Sensitivity”

- These may be reduced lactose but are NOT lactose free and should be used for
  - “for the fussy baby”
  - Gastroenteritis
    - Rarely and only for a short time during convalescence
- Lactose plays an important role so only use with diagnosed conditions
- Protein Source
  - Whey : Casein ratio is 20 : 80

Some Products Available
- Parent’s Choice Sensitivity
- Similac Sensitive
For fussiness and gas due to lactose sensitivity*

Most babies are fussy and gassy at times. But if it seems your baby has more frequent fussiness and gas, it could be a sign that he might need another baby formula.

You can trust Similac Sensitive to provide a strong start for your baby's developing digestive system.

*Not intended for use by infants and children with galactosemia
It is not uncommon that allergies to cow’s milk also occur with soy milk.

Soy protein is NOT hypoallergenic:
- Should not be used if a protein allergy is suspected
- No evidence to use soy formula for:
  - Cow’s Milk protein allergy
  - Colic
  - Acute Gastroenteritis

Difference is in the Carbohydrate source:
- Cornstarch hydrolysate or sucrose
Soy Formulas and Premature Infants

- Not recommended for Preemies
  - Increased chance of osteopenia due to poor calcium absorption
  - Poorer absorption of iron, zinc, phosphorus
  - Generally need higher caloric content also
- Clinical dietician should assist with premature diets
## Indications for Soy Formula
- Congenital Lactase Deficiency
- Galactosemia
- Parental preference for Vegan diet
  - Vit D source is non-vegan so it's not really vegetarian

### Soy Formulas

<table>
<thead>
<tr>
<th>Products</th>
<th>Calories</th>
<th>Lactose</th>
<th>Additives</th>
<th>Hypoallergenic</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Standard Soy</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Enfamil Prosobee</td>
<td>20 kcal</td>
<td>None</td>
<td>(DHA/ARA all)</td>
<td>No</td>
</tr>
<tr>
<td>Similac Sensitive Isomil</td>
<td>20 kcal</td>
<td>None</td>
<td>Prebiotic</td>
<td>No</td>
</tr>
<tr>
<td>Parent’s Choice Soy</td>
<td>20 kcal</td>
<td>None</td>
<td></td>
<td>No</td>
</tr>
<tr>
<td></td>
<td>20 kcal</td>
<td>None</td>
<td></td>
<td>No</td>
</tr>
<tr>
<td><strong>Modified Soy</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Good Start Soy Plus</td>
<td>20 kcal</td>
<td>None</td>
<td>(DHA/ARA)</td>
<td>PHF, but Not</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>hypoallergenic</td>
</tr>
</tbody>
</table>
Anti-Reflux Formulas

- For diagnosed GERD (poor weight gain)
  - Happy spitters do NOT need special formula
- Protein Source
  - Whey : Casein ratio is 20 : 80
- Added rice starch
  - Thin going in and thickens in the stomach when it reacts with acid
  - Decreased vomiting but unclear if improved G & D

Some Available Products

- Enfamil AR
- Parent’s Choice Added Rice Starch
- Enfamil Restfull
- Similac Sensitive for Spit up
  - Also lactose free with prebiotics
Extensively Hydrolyzed Cow’s Milk formula (EHF)
  - Better practice is to breast feed at least 4-6 months

For use with
  - Milk protein allergy
  - Prevention of atopic disease in high risk infants
  - Malabsorption diseases

Properties
  - High casein with DHA/ARA
  - Lactose free

Some Available Products
  - Enfamil Nutramigen
  - Nutramigen with Enflora (added probiotic)
  - Enfamil Pregestimil
  - Similac Alimentum
No milk protein is used

- For severe milk protein hypersensitivity that is NOT tolerating extensively hydrolyzed formula

Protein source is free amino acids

- Very expensive
- Can be bought without a script
- Difficult via WIC

Some Available Products

- EleCare
- Neocate
- Nutramigen AA
Determining the Cause of the Formula Intolerance

LACTOSE INTOLERANCE (CHO)
- Rare under 1 year of age
- Small intestine does not make enough of the enzyme lactase
- Signs/symptoms
  - Abdominal pain
  - Diarrhea
  - Flatulence

MILK PROTEIN ALLERGY
- Rare, <6% of population
- Strong family history of atopic disease
- Signs/symptoms
  - Begins early (days/weeks)
  - Bloody stools
  - Diarrhea
  - Vomiting
  - May see skin symptoms
Choose the Formula Accordingly

- Normal
  - Standard Cow’s Milk Formula
    - GERD
      - Anti-reflux formula
    - Milk Protein Allergy
      - Hypoallergenic Formulas (EHF)
      - Lactose-Free Formula
        - Soy Formula
      - Still not tolerating formula
        - Amino Acid Based Formula

- Full term infant
  - Galactosemia
  - Lactase deficiency
Suggestion for Effectively “Prescribing” Formula

- Make yourself a list with only one or two products for each category
  - It is nearly impossible to keep up with all the formulas on the market
- Talk to parents about
  - Cost
  - Where they were able to purchase it
  - Likes and dislikes about the particular product
- Know the local WIC rules
- Add this information/update your list
GER is a normal physiologic process in infants
- Effortless vomiting with a normally growing infant
- 50% of infants <3 mos regurgitate at least once daily
- >95% resolve by the 24 months

GERD occurs when there is growth alteration
- Treatment goals are to
  - Alleviate symptoms
    - Irritability, disturbed sleep, excessive crying
  - Promote normal growth
  - Prevent complications
    - Esophagitis, hematemesis, esophageal stricture, Barrett’s esophagitis, chronic OM, sinusitis, anemia, apnea and chronic respiratory disease
GERD

- **Diagnostics**
  - 24 hour esophageal pH probe (reflux)
  - Barium Swallow (anatomical defects)
  - Upper GI endoscopy with biopsy (cell changes)
  - Scintigraphy (reflux)

- **Treatment may consist of**
  - Lifestyle changes
  - Altering viscosity of feedings
  - Altering gastric pH
  - Altering the motility of the gut
  - Surgical options (nissan fundoplication)
Lifestyle and Viscosity of Feedings

- Adjust feeding volume and frequency
- Positioning after feedings
  - Upright without increased pressure on diaphragm
  - Prone as long as infant is awake
- Thickening Formulas
  - As was noted with specialty formulas
  - 1 Tbsp rice cereal with each ounce of regular formula
    - May decrease gastric emptying and increase GER
    - Will increase calories to ~34/ounce
  - Gaviscon is used in the UK but not endorsed by AAP
Antacids
- Insufficient evidence to make a recommendation

Histamine receptor antagonist
- Reduces histamine-induced gastric acid secretion and pepsin output
- Ranitidine is most commonly used (1 mos – 16 yrs)
  - 4-10mg/kg/day in two divided doses with 300mg max
- Famotidine is used 1 mos – 16 years
  - 1mg/kg/day in 2 divided doses with 80mg max
- Nizatidine and Cimetidine-not used in infants
Proton Pump Inhibitors (PPI)

New warning for PPIs: possible increased incidence of C Difficile-Associated Diarrhea

- Increases the pH of gastric contents, decreases volume of secretions, and facilitates emptying
- Lansoprazole is used newborn and up
  - < 10 weeks dose is 0.2-0.3mg/kg/dose once daily
  - > or = to 10 weeks dose is 1-2mg/kg/dose once daily
  - 15mg daily if < or = to 30 kg; 30mg daily if >30kg
- Omeprazole is used newborn and up
  - Infant dose is 0.7mg/kg/dose once daily
  - 5mg daily if 5 to <10kg
  - 10mg daily if 10 to <20kg; 20mg daily of >20kg
Prokinetics act to accelerate gastric emptying

Metoclopramide
- Limited use because of side effects of tardive dyskinesia from crossing the BBB

Erythromycin
- Increases antral contractions along with duodenal
- Cautionary use in neonates; 30-50mg/kg/day has been associated with a 10 fold increase in risk of hypertrophic pyloric stenosis
- Better efficacy in full term infants versus premies
  - 10mg/kg/dose every 8 hours
Symptomatic during long-term medical treatment

Significant side effects from medications

Aspiration

Standard procedure is Nissen Fundoplication

- Wrapping the fundus of the stomach around the LES to reinforce the antireflux barrier
- Can be done via laparascopy
Thank You

Questions?
Chart for Formulas
doi: 10.1542/pir.32-5-179


http://www.cdc.gov/vaccines/acip/index.html