The nutritional requirements of preterm infants are greater than the requirements for term infants. Feeding intolerance is common in the preterm infant due to intestinal immaturity. Using gastric residuals to determine signs of feeding intolerance has been routine practice in the NICU and has not been shown to be useful for deciding to hold feeds.

| NICU, enteral feeds, feeding tube, gastric residuals, feeding intolerance |

### Gastric Residuals in Preterm Infants

**Purpose and Goal: CNEP # 2088**

- Understand the challenges of feeding preterm infants.
- Learn about gastric residuals as a sign of feeding intolerance.

None of the planners, faculty or content specialists has any conflict of interest or will be presenting any off-label product use. This presentation has no commercial support or sponsorship, nor is it co-sponsored.

**Requirements for successful completion:**

- Successfully complete the post-test
Complete the evaluation form

Date

- November 2018 – November 2020

Learning Objectives

- Describe the negative effects of withholding feeds.
- Describe the signs of feeding intolerance in the neonate.
- Identify 2 approaches for managing residuals in the NICU.

Introduction

- Aspiration of gastric contents is routine in the NICU
- It has been used to evaluate infant feeding tolerance
- It has also been used to evaluate infant feeding intolerance
- There is little evidence that this practice is beneficial

Nutritional Needs of the Preterm Infant

- Preterm infants have greater nutritional needs
  - To mimic intrauterine fetal growth
  - To provide optimal neonatal growth
- There are several reasons for this greater need:
  - Preterm infants are often growth restricted
  - GI tract immaturity may impede absorption
    - Decreased gastric motility
    - Reduced intestinal enzyme activity
  - Medical conditions increase metabolic needs
  - Medical treatments may impede growth
    - Corticosteroid use
• Nutritional strategies must balance concerns for:
  • Possible feeding intolerance
  • Possible necrotizing enterocolitis
• Feeding intolerance / delays are known to cause:
  • Atrophy of intestinal mucosa
  • Decreased intestinal size and weight
  • Delayed maturation of intestinal motility
  • Delayed maturation of intestinal enzymes
  • Increased intestinal permeability
  • Increased intestinal bacterial translocation
  • Absent intestinal hormone responses
• Aspiration and evaluation of gastric residuals
  • Is controversial in the NICU
  • Is used to assess gastric emptying
  • Is not always useful in assessing intolerance

Gastric Residuals in the Preterm Infant

• Aspiration of gastric residuals has been used to:
  • Verify feeding tube placement
  • Evaluate gastric contents
  • Evaluate feeding tolerance
  • Prevent aspiration → VAP
• Gastric residual volumes are:
  • An indication of gastric emptying
  • An indirect measure of intestinal function
  • A non-specific measure of gut pathology
• Gastric residuals reflect changes in:
  • Infant position
  • Intestinal function
  • Feeding tube position
• Abnormal residuals have been defined as:
  • >2 ml/kg per feeding
  • >50% of feeding volume
Evaluation of Gastric Contents

- Gastric residual evaluation
  - Is based on the assumption that:
    - Residual measurement is valid
    - Residual measurement is accurate
  - Is influenced by infant position:
    - Residuals are increased
      - Supine position
      - Left lateral position
    - Residuals are decreased
      - Prone position
      - Right lateral position
- Feeding tube size can also alter residuals
  - Larger tubes aspirate 2-3 times more
  - Position of tube holes impacts residuals
- Other variables
  - Aspiration technique
  - Feeding temperature
  - Feeding viscosity

Evaluation of Feeding Intolerance

- Feeding intolerance is common in preterm infants
  - Due to gastric immaturity
  - Due to decreased intestinal motility
- Intolerance is generally associated with:
  - Emesis
  - Visible bowel loops
  - Abdominal distention
  - Increased abdominal girth
  - Abnormal gastric residuals
- Gastric residuals traditionally used to assess:
  - Volume of residuals
  - Appearance of residuals
  - Association with NEC
• NEC is a concern in preterm infants
  • It causes intestinal inflammation
  • Inflammation → intestinal necrosis
  • Necrosis increases morbidity / mortality
• Using residuals as an indicator for NEC
  • Assumes several things are true:
    • Residual volumes are accurate
    • Volumes reflect gastric contents
    • Volumes reflect gastric emptying
    • Volumes indicate feeding intolerance
      • Low volumes reflect gastric emptying
      • High volumes reflect intestinal necrosis
  • None of these assumptions have been validated
• Studies suggest residuals only be used:
  • When other signs of intolerance are present
  • When other signs of NEC are present

Re-feeding or Discarding Gastric Residuals

• Gastric residuals are often discarded
• Decisions to discard or re-feed can be based on:
  • Individual nurse beliefs
  • Individual nurse judgment
  • Individual nurse experience
  • Individual NICU tradition
• When residuals are discarded
  • Important elements are lost
    • Pepsin
    • Hydrochloric acid
  • Hydrochloride acid limits intestinal bacteria
    • When hydrochloride acid is lost
    • Intestinal bacteria may increase
      • Which can lead to inflammation
        • Increased risk of sepsis
        • Increased risk of NEC
Evaluation of Abnormal Gastric Residuals

- There is no clear definition of what is abnormal
- Residuals are the commonly used to:
  - Decide when to advance feeds
  - Decide when to interrupt or hold feeds
- The evaluation of residuals should include:
  - Feeding tube placement
  - Infant positioning between feeds
  - Changes in medical condition
  - Quality of gastric residuals
- Acceptable types of residuals
  - Milk
  - Partially digested milk
  - Mucous
  - Few blood streaks
  - Bilious with beginning feeds
- Unacceptable type of residuals
  - Coffee ground
  - Bilious with established feeds
- Increased or bilious residuals may indicate:
  - Gastric over distention
    - With reflux of bile
  - Feeding intolerance
  - Early onset of NEC
- Bilious residuals without other changes:
  - Are not a sign of feeding intolerance
  - Are not associated with suspected NEC

Indications to Consider When Holding Feeds

- Residuals without other signs of intolerance
  - Should not be used to hold feeds
- Other signs that indicate feeds should be held:
  - Significant abdominal distention
    - >2 cm increase
• Significant abdominal discoloration
  • Erythema
  • Other acute color change
• Significant cardiopulmonary instability
  • ↑ Apnea
  • Bradycardia
  • Tachycardia
  • Hypotension
• Bloody residuals or emesis
• Obvious blood in stool
  • Frank blood in stools
  • Current jelly stools
• Gastric residuals 3 ml/kg
  • For small trophic feeds
• Gastric residuals >50% of feed
  • For 2-3 bolus feeds
• Gastric residuals >2 hour volume
  • For continuous drip feeds

Management of Gastric Residuals

• There are a few safe guidelines to remember
• For the first residual
  • If low volume
  • If moderate volume
  • Give residual back
  • Give whole new feed
• For subsequent residuals
  • Notify provider
  • Give residual back
  • Give difference of whole feed
  • Consider holding current feed
  • Consider holding feeding advance
  • Consider increasing feeding time
  • Consider change in infant position
  • Consider use of glycerin for no stool
• For new onset residuals with full feeds
  • Give residual back
  • Hold current feed
  • Recheck residual with next feed
  • Restart feeds if residual has resolved
• Whenever possible, give the residual back
• If other signs of intolerance are present
  • Hold feeds
  • Notify provider
  • Check abdominal x-ray
  • Evaluate infant for NEC

Potential Risks Associated with Aspiration

• There are risks associated with aspiration
• Interrupting feeds interrupts optimal nutrition
• Optimal nutrition is essential for preterm growth
• Delayed nutrition is associated with complications:
  • Prolonged need for TPN
  • Increased risk of liver disease
  • Increased risk of central line infection
  • Adverse neurodevelopmental outcomes
• Delayed feeds alter gastric peptide secretion
  • Changes structure of GI tract
  • Decreases function of GI tract
  • Significantly impacts feeding tolerance
• Aspiration may damage gastric mucosa
  • Negative pressure created with aspiration
  • Feeding tube holes are close to gastric mucosa

Summary

• The routine aspiration of gastric residuals
  • Is standard practice in most NICUs
  • Is often used to determine feeding tolerance
• The use of gastric residuals by themselves is not useful
• Other signs of feeding intolerance should be present
• Preterm infant nutrition and GI tract development
  • It essential to ensure optimal developmental outcomes

References


Evaluation

Required fields

Your information
*Your name

*Your email address
Test

- Aspiration of gastric residuals is thought to assess intestinal function.
  - True
  - False

- Gastric residuals are the most common reason feeds are held.
  - True
  - False

- Greater than 50% of a feeding is considered an abnormal residual.
  - True
  - False

- There is clear evidence gastric residuals are associated with NEC.
  - True
  - False

- Evaluation for feeding intolerance includes assessing for more than gastric residuals.
Interrupting or holding feeds can lead to delayed maturation of the GI tract.

Evaluation

We hope you found this educational offering both interesting and informative. We’d like to hear from you and appreciate you taking the time to answer these evaluation questions.

*Were you able to complete this activity in the allotted time?
  ○ Yes
  ○ No

Were you informed of the following disclosures?

*Purpose of learning activity
  ○ Yes
  ○ No

*Requirements for successful completion of this CNE activity
  ○ Yes
  ○ No

*Presence or absence of conflict of interest of planning committee members
  ○ Yes
  ○ No
*Presence or absence of conflict of interest of content specialist(s)/author(s)/feedback person(s)
  ○ Yes
  ○ No

*Were your personal objectives successfully achieved?
  ○ Yes
  ○ Somewhat
  ○ No
If not, why not?
  

*What one thing might you do differently in your practice after this session?
  

Please evaluate the brief:

*Presentation organized
  ○ Excellent
  ○ Very good
  ○ Good
  ○ Fair
  ○ Poor

*Materials offered relevant content
  ○ Excellent
  ○ Very good
  ○ Good
  ○ Fair
  ○ Poor
*Assistance provided as needed
○ Excellent
○ Very good
○ Good
○ Fair
○ Poor
○ Not applicable

*Overall strength of presentation
○ Excellent
○ Very good
○ Good
○ Fair
○ Poor

Stated objectives achieved?

* Describe the negative effects of withholding feeds in the preterm infant.
○ Excellent
○ Very good
○ Good
○ Fair
○ Poor

* Describe the signs of feeding intolerance in the preterm infant.
○ Excellent
○ Very good
○ Good
○ Fair
○ Poor

* Identify 2 approaches for managing gastric residuals in the NICU.
- Excellent
- Very good
- Good
- Fair
- Poor