Gastric Residuals

Katherine Kuniyoshi, MD, FAAP, MPH

Pathophysiology of Gut Motility and Gastric Emptying

- Gastric Residuals Historically
- Problems with Gastric Residuals
- Changes in Practice

Gut Motility and Gastric Emptying
Preterm Infants

- Are born with limitations in their ability to digest appropriately due to anatomical and functional issues
- The more preterm the infant, the more disorganized and immature the intestinal motor activity is
- Esophageal peristalsis is immature and bidirectional in preterms with appropriate forward movement only near term.

Preterm Infants

- Slower gastric emptying due to the immaturity of GI tract
  1. Immature suck-swallow coordination
  2. Immature LES tone and function
  3. Low %age of gastric electric slow wave
  4. Slower intestinal transit

Riezzo, 2000

Preterm Infants

- Basal gastric secretions average 2.8ml over a 4 hour period
- In preterm infants receiving small volumes of enteral feeds, the potential is there for GR volumes to exceed feeding volumes (secondary to basal secretions)
- Gastric emptying is regulated by antral and duodenal motor activity that is controlled via neurohormonal input as well as by pyloric function
- Preterms (especially those <31 weeks) have an immature response to feeding (lack of duodenal contractions) which results in a delay to GE

Riezzo, 2000
What can Influence Gastric Emptying:

1. The timing of initiation
2. Type of enteral feeding
3. Mode of administration

Timing of initiation

- Early enteral feeds increase maturation of motor function (ex. Increased duodenal motor activity)
- The administration of MEN (feeds <24cc/k/d for intestinal maturation and protection rather than nutrition) increases the maturation of migrating motor activity and promotes Gastric Emptying

Owens, 2002

Type of Enteral Feed

- Gastric emptying (GE) increased by decreased osmolarity with increased volume
- Human milk shown to have more rapid GE than formula
- Unclear how fortification influences GE
- Gathwala et al. reported that there was no difference in feeding tolerance when human milk was fortified.
Mode of enteral feeds

- Compared to bolus feeds, continuous feeds enhance duodenal motor responses and hastens GE

- A recent Cochrane review, however, found inconclusive evidence to support the use on CNG feeds vs bolus feeds

Yue-Feng Li, 2014

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Gastric Residuals

Historically

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Gastric Residuals

- Many NICUs routinely check gastric residuals prior to feeds in VLBW preterms
- Scant information exists regarding risks and clinical benefits associated with this common procedure
- Because of this fact, some NICUs are abandoning this practice
Main Issues Regarding Checking Residuals
1. Its use to confirm correct placement of OG/NG tube
2. Its use as indicator for gastric contents
3. Its use as an indicator for Feeding Intolerance or NEC
4. Its use to prevent gastric aspiration
5. Discard or Re-feed?
6. What’s considered Abnormal?

Feeding Tube Placement
• Correct placement necessary to prevent complications such as:
  1. Aspiration
  2. ABDs
  3. Trauma
  4. Placement into respiratory tract
• Unreliable indicator
  Parker, 2014
Use of GR to Verify Feeding Tube Placement

- The absence of GR does not necessarily indicate incorrect placement
- May be dependent upon:
  1. Body position
  2. Gastric Emptying time
  3. Previous feeding volume
  4. If feeding tube tip positioned in pool of gastric fluid

Parker, 2014

Use of GR as Indicator of Gastric Contents

- Decisions regarding whether or not to withhold or advance feeds are frequently made on the basis of GR volumes
- Body position can influence volumes
  1. Sanger et al
  2. Cohen et al
  3. Chen et al

Sanger et al
Cohen et al
Chen et al

Use of GR as Indicator of Gastric Contents

- Size of feeding tube: Larger bores can aspirate 2-3 times volume of smaller bores
- Positioning of feeding tube holes within pool of gastric fluid
- Aspiration technique
- Feeding temperature
- Viscosity

Bartlett et al, 2014
Use of GR as Indicator of Feeding Intolerance

*Feeding Intolerance*: typically associated with
- Emesis
- Visible bowel loops
- Increased abdominal girth
- Abdominal distension
- Presence of “Abnormal GR”

Since the volume and appearance of GRs is one of the most commonly employed indicators of feeding intolerance

Often used to determine advancement or withholding of enteral feeds

Mihatsch, 2002

Use of GR as Indicator of Feeding Intolerance

- Lack of evidence supporting the relationship between GR volume or appearance and feeding intolerance in neonates
- In absence of other signs, no correlation between light green GRs and Feeding Intolerance nor NEC

Mihatsch, 2002
Use of GR as Indicator of Feeding Intolerance

- Undergoing routine aspiration and evaluation of GRs delayed attainment of full feeds (150ml/k/d) by 6 days
- Required 6 more days of central venous access

Torrazza, 2014

Use of GR as Indicator of NEC

- A potentially fatal condition characterized by intestinal necrosis and inflammation
- Affects 7-11% of VLBWs
- The presence of abnormally large GRs has historically thought to be an early indicator of NEC

Bertino, 2009

Use of GR as Indicator of NEC Assumes:

1. The volume of aspirated GR is an accurate measurement of residual gastric contents
2. The volume of GR provides accurate information regarding gastric emptying
3. A elevated GR indicates delayed gastric emptying and feeding intolerance
4. A low GR volume indicates the stomach is emptying properly and the infant can tolerate feedings
5. Elevated GRs are reflective of distal intestinal necrosis.

Bertino, 2009
Use of GR as Indicator of NEC

- Currently unclear whether the presence of a large GR is a reliable indicator
- What is a “Concerning” volume of GR?
- The timing of increases in GR volume prior to Dx of NEC is unpredictable
- Therefore, unreliable red flag to warn of any pending clinical deterioration.

Parker, 2015

“Significant” GR Volume

Kaminski, 2014
Other NICUs
NICU-Net

We don't check residual volume routinely. Aspiration of gastric is usual in cases with abdomen over distention, vomiting...

NursingNote
Medical round #7
Neonatologist

We check gastric residual volumes but have no guidelines. Each clinic reacts on a case-by-case basis.

0.5
Residual volume:
< 5mL return stomach content and feed additional 20mL of milk
5-10mL feed 20mL, including residual content
> 10mL skip a feeding or stop

Ryo Sakaiz, MD
from Japan

We recently eliminated checking aspirate volumes before feeds. The nurses evaluate abdominal distention, color, 5x/res, tone, and overall change in room since last feed.

Morita LR Richards
TMC for Children
Tucson, Arizona

We never do it routinely. Only if the baby has any abdominal symptoms. We have few low NEC

El 6 jun 2016, a las 13.51, ry.sakaiz@... (nicu-net) <nicu-net@groups.google.com> escribió:

We have not checked aspirates other than for tube placement for some time as evidence does not support it being useful to base care on. It only provokes slow gut motility which we already know about. Vomiting is another matter...

Carmen Cyri Ruyter
Beacon MA

I moved from a NICU that no only checked residuals but often make babies NPO "overnight". By the time we would see the kid on rounds it was a significant delay in feeding. now at MUSC with a strong neonatal nutrition team and are in a unit with aggressive feeders who largely ignore these kind of things and "feed through" more stuff... save a LITT! LITT NEC, I am still learning, LOL.

Rita M. Ryan, MD
Chair and Professor, Department of Pediatrics
Medical University of South Carolina
Pediatrician-in-Chief, MUSC Children's Hospital
Problems

• Lack of standards regarding GR
• Wide variation in practice regarding:
  1. Evaluation of feeding tube position
  2. Frequency of GR evaluation
  3. Standards regarding discarding or re-feeding
  4. What constitutes a “significant” GR volume or quantity

Bertino, 2009

Bilious or Blood Tinged Residuals

• Without other clinical signs, these residuals are likely benign and are due to:
  1. Duodenogastric reflex from immature pyloric sphincter
  2. Immature duodenal motor activity
  3. Mucosal irritation from NGT insertion or upper airway suctioning
  4. Stress related gastric bleeding
Problems

Theoretically, the negative pressure created by aspiration (8-12 times per day) plus close proximity to gastric mucosa

Mucosal damage

Yue-Feng, 2014

Problems

- This wide variation and lack of uniformity results in:
  1. Unnecessary prolongation of IV nutrition
  2. Increased risk of late onset sepsis
  3. Extraterine growth restriction
  4. Adverse neurodevelopmental outcomes
  5. Parenteral nutrition associated liver disease

Moore, 2011

Change in Practice
References

References