What is the Best Prep and How Do I Assess the Adequacy of the Prep

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ACG Annual Postgraduate Course
October 17, 2015

Time For Your Colonoscopy
(The Prep was Rough)....
**Colonoscopy Preparation: Importance**

- Incomplete colonoscopy common
  - Some estimates up to 10%
  - Inability to achieve cecal intubation
  - Inability to visualize mucosa effectively

- Inadequate bowel preparation leads to
  - Missed lesions
  - Increased risk of procedure related adverse events

- Bowel prep is a colonoscopy quality indicator


**Colonoscopy Preparation: Ideal**

- Reliably empty colon of all fecal material
  - Rapidly
  - No changes in gross or histologic appearance of colon

- No shifts in fluids or electrolytes

- No patient discomfort

- Safe

- Convenient

- Well tolerated

- Inexpensive
Colonoscopy Preparation: General Considerations

Predictors of inadequate bowel preparation
- Previous inadequate bowel preparation
- Language barriers
- Financial barriers
- Inpatient status
- Polypharmacy (especially opiates)
- Obesity
- Male
- Comorbidities
  - Stroke, dementia, Parkinson’s
- Poor adherence to instructions
- Longer wait times for colonoscopy appointments

Many of these are modifiable

Colonoscopy Preparation: General Considerations

Improving preparation
- Effective education
  - Written instructions—simple, easy to follow, native language
  - Educational booklets
  - Visual aids
  - Smartphone apps
  - Internet resources
    - ACG: Your doctor has ordered a colonoscopy
    - ASGE: Understanding bowel preparation
Colonoscopy Preparation: Timing

Split dose

- Results in higher quality bowel preparation than ingestion night or day before
- Better bowel prep leads to higher adenoma detection rate
- Improves patient tolerability
- Typically split between night before and day of test
- Timing of second dose
  - Must allow for ingestion, desired responses and travel to test
  - Typically 4-6 hours before test


Colonoscopy Preparation: Timing

Split dose

- Residual gastric fluid equivalent with split dose and when full dose given evening before test
- ASA guidelines sate no fluids for 2 hours prior to test
  - Institutional policies vary
- Morning procedure times
  - “Second dose” may need to start at 2 or 3 AM
  - Education of patient is key
- Hospitalized patients
  - Split dose vs. day of procedure (morning) dosing similar
Colonoscopy Preparation: Timing

Morning only

– Appropriate for motivated patients with afternoon procedures
  • Equivalent or superior bowel preparation
    – Better tolerability
    – Less impact on daily activities
    – Better sleep quality


Colonoscopy Preparation: USMSTF 2014

• “Use of split dose bowel cleansing regimen is strongly recommended for elective colonoscopy”
• “Same day regimen acceptable alternative to split doing, especially for patients having afternoon procedures”
• “Second dose should begin 4-6 hours before time of colonoscopy, and completed at least 2 hours before procedure time”

Colonoscopy Preparation: General Considerations

- Combination of dietary restriction and cathartics
- Clear liquid diet commonly recommended up to 2 hours before
  - Avoid red liquids
  - Low residue diet may be as effective as clear liquid diet
    - Increases patient satisfaction
  - Attention to medications such as iron, diabetes medications and anticoagulants/antiplatelet agents

Regimens for Bowel Preparation

- Osmolarity
  - Isosmotic
  - Hyposmotic
  - Hyperosmotic

- Fluid volumes
  - “High volume”
    - At least 4 liters cathartic solution
  - “Low volume”
    - Lower volumes of cathartics, but often with additional fluids
Regimens for Bowel Preparation: Isosmotic

High volume polyethylene glycol preparations

— Polyethylene glycol (PEG)
  • Inert polymer of ethylene oxide
  • Non-absorbable solution
  • Pass through bowel without absorption or secretion
  • Osmotically balanced with non-fermentable balanced electrolyte solutions
  • 4 liter PEG-ELS is “gold standard”
    — Note not approved to be used in split dose fashion, although ample evidence suggests this as best practice

Regimens for Bowel Preparation: Isosmotic

High volume PEG-ELS preparations (Golytely)

— Generally well tolerated
— 5%-15% do not complete
  • Large volume, abdominal cramping, fullness
  • Sulfate associated taste (only partially masked by flavors)
— No change in patient weight, electrolytes, histology
— Safe for patients with CHF, renal failure, ascites
— Addition of bisacodyl, prokinetics or enemas does not improve outcomes
— May be used via NG tube and in 6-8 liter fashion for rapid purge
Regimens for Bowel Preparation: Isosmotic

High volume PEG-ELS preparations
- Significant adverse events generally rare
  - Nausea
  - Vomiting
  - Aspiration (rare)
  - Mallory-Weiss tear
  - Pancreatitis
  - Lavage induced pill malabsorption
  - Cardiac arrhythmias

Regimens for Bowel Preparation: Isosmotic

Sulfate-free PEG-ELS (*Nulytely, Trilyte, Colyte*)
- PEG based lavage solutions developed to improve taste and smell of PEG-ELS
  - Improved taste
    - Elimination of sodium sulfate
    - Decrease in potassium
    - Increase in chloride
- Sulfate free PEG-ELS compared to PEG-ELS
  - Less salty
  - More palatable
  - Equal for colon cleansing and safety

Regimens for Bowel Preparation: Isosmotic

Low volume PEG preparations

– Designed to provide more tolerable bowel preparation and similar efficacy to original 4 liter PEG-ELS solutions

– One low volume 2 liter PEG-ELS with ascorbic acid is FDA–approved and available in 2015 (*Moviprep*)
  • Requires one additional liter of clear liquid
  • Similar efficacy to 4 liter PEG-ELS
  • Ascorbic acid may provoke hemolysis in patients with G6PD deficiency

Ell C, et al. *Am J Gastroenterol* 2008:103;888-93

Regimens for Bowel Preparation: Hyposmotic

Low volume PEG preparations

PEG-3350-SD (*Miralax-SD*)

– Low volume PEG solution (PEG-3350) with additional of commercially available electrolyte solution (sports drink)
  • Hyposmotic
  • Not FDA approved for colonoscopy preparation
  • Not equivalent to FDA approved 2 liter isotonic PEG-ELS solutions
Regimens for Bowel Preparation: Hyposmotic

PEG-3350-SD
- Widely used
- Often administered with bisacodyl
- Mixed results compared to standard 4 liter solutions
  - Generally equivalent
  - Safety issues
    - Bisacodyl addition benefit unclear
    - Theoretical potential for unabsorbed carbohydrates to be metabolized to explosive gases, but no reports
    - Hyponatremia reported
    - Metabolic effects of PEG-3350-SD similar to other PEG-ELS


Regimens for Bowel Preparation: Hyperosmotic

Oral sodium sulfate (Suprep)
- Hyperosmotic, but not seen to have significant fluid shifts due to sulfate being poorly absorbed
- Non inferior to 2 liter PEG-ELS with ascorbic acid
- Better results in one study than 4 liter SF-PEG-ELS
  - Less bloating
  - More frequent excellent prep (71% vs 34%, P=0.01)
- Superior successful prep in one study vs sodium picosulfate/magnesium citrate (95% vs 86%, P=0.06)
- No serious reported adverse events

Rex DK, et al. Gastrointest Endosc 2014;80;1113-23
Regimens for Bowel Preparation: Hyperosmotic

Magnesium citrate
- Magnesium cations act osmotically
- Stimulates release of CCK
- Not FDA approved as a colonoscopy preparation
- Limited efficacy data, rarely used alone
- Avoid in patients with renal disease

Sodium phosphate
- Low volume hyperosmotic aqueous solution
- Associated with phosphate nephropathy
  * Often in patients with poor renal function, HTN on ACE inhibitors or ARBs, but also with normal renal function
- Associated with hyperphosphatemia in up to 40%
- Brand name solution voluntarily removed from market
  * Not recommended as a colonoscopy preparation
  * Available “over the counter” as a laxative
- Tablet form (Osmoprep) available but has black box warning

Regimens for Bowel Preparation: Combination Agents

Sodium picosulfate/magnesium citrate (Prepopik)
- Sodium picosulfate is a stimulant laxative in the colon
  - Increases frequency and force of peristalsis
- Magnesium citrate is an osmotic laxative
- Superior in one trial and non-inferior in another trial compared with 2 liter PEG-ELS and bisacodyl administered day before procedure (overall adequate cleansing 83%-84%)
- Adverse events
  - Increased cramping, nausea/vomiting
  - Electrolyte disturbances


Regimens for Bowel Preparation: Combination Agents

Oral sodium sulfate/SF-PEG-ELS (Suclear)
- Compared to 2 liter PEG-ELS and ascorbic acid
  - Similar successful bowel preps (94%)
  - More vomiting
- Compared to PEG-ELS and bisacodyl
  - Successful bowel prep: Non inferior
  - Overall discomfort slightly worse for sodium sulfate/SF-PEG-ELS
- No major adverse events

## Regimens for Bowel Preparation

**Table 2. Commonly available bowel preparations**

<table>
<thead>
<tr>
<th>Regimen</th>
<th>ENEMA SE</th>
<th>SIF/ENEMA</th>
<th>Low Volume PRO.360.55</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Drug</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>PEG/ENEMA</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Symptom</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Stool</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Opaque</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sanguine</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Dark</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Prep.</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1 x 2000</td>
<td></td>
<td>1 x 2000</td>
<td>1 x 2000</td>
</tr>
<tr>
<td>2 x 2000</td>
<td></td>
<td>2 x 2000</td>
<td>2 x 2000</td>
</tr>
<tr>
<td>3 x 2000</td>
<td></td>
<td>3 x 2000</td>
<td>3 x 2000</td>
</tr>
<tr>
<td><strong>Contraindications</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Intestinal obstruction</td>
<td>No</td>
<td>No</td>
<td>No</td>
</tr>
<tr>
<td>Pregnancy</td>
<td>No</td>
<td>No</td>
<td>No</td>
</tr>
<tr>
<td>Hypersensitivity</td>
<td>No</td>
<td>No</td>
<td>No</td>
</tr>
<tr>
<td><strong>Notes</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Use as directed</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
</tbody>
</table>

**Table 3. Contrast**

<table>
<thead>
<tr>
<th>Oral sodium sulfate</th>
<th>Oral sodium sulfate with PEG/ENEMA</th>
<th>Sodium phosphate/magnesium citrate (SPT-10)</th>
<th>Magnesium citrate</th>
<th>NaCl injection</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sodium sulfate</td>
<td>Sodium phosphate/magnesium citrate</td>
<td>Sodium phosphate/magnesium citrate</td>
<td>No</td>
<td>1000 cc</td>
</tr>
<tr>
<td>12 oz</td>
<td>4 oz PEG/ENEMA</td>
<td>4 oz PEG/ENEMA</td>
<td>4 oz PEG/ENEMA</td>
<td>1000 cc</td>
</tr>
<tr>
<td>24 oz</td>
<td>8 oz PEG/ENEMA</td>
<td>8 oz PEG/ENEMA</td>
<td>8 oz PEG/ENEMA</td>
<td>1000 cc</td>
</tr>
</tbody>
</table>

**Notes**

- Use as directed
- Avoid in patients with renal insufficiency
- Avoid in patients with bowel obstruction
- Sodium should be administered with 2000 cc of water before EGD

**Table 4. Other preparations**

<table>
<thead>
<tr>
<th>Preparation</th>
<th>Contraindications</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>PEG/ENEMA</td>
<td>No</td>
<td></td>
</tr>
<tr>
<td>Sodium</td>
<td>No</td>
<td></td>
</tr>
<tr>
<td>Magnesium</td>
<td>No</td>
<td></td>
</tr>
</tbody>
</table>
Regimens for Bowel Preparation: Additional Agents

Laxatives
- Bisacodyl or magnesium citrate
  - Used to try to reduce volume of lavage solution needed
- Bisacodyl
  - Some studies show use allows lower volume of PEG-ELS
  - Associated with abdominal cramping and ischemic colitis
  - Not FDA approved in any available commercially available prep
- Magnesium citrate
  - May improve outcomes when used with 2 liter SF-PEG-ELS as compared to 4 liter PEG-ELS (equal efficacy, better tolerability)
  - Avoid in renal failure or renal insufficiency

Regimens for Bowel Preparation: Additional Agents

Flavoring
- PEG-ELS available in multiple flavors
- Use of other drinks as flavoring
  - Renders solutions no longer isotonic
  - Substrates possibly metabolized to explosive gases
  - May not actually improve tolerance even if improves flavor
- One study supports use of sugar-free menthol candy drops to improve tolerability

Regimens for Bowel Preparation: Additional Agents

- **Metoclopramide**
  - No change in colonic motility
  - May reduce nausea and bloating
  - No impact on colon cleansing
  - Not recommended

- **Simethicone**
  - May reduce number of adherent bubbles present on exam
  - No change in quality of bowel preparation

Documentation of Bowel Preparation Quality

US Multisociety Task Force (USMSTF) on Colorectal Cancer

- Definition of adequate examination
  - Confident that lesions other than < 5 mm can be seen
- Grading of prep quality should be done
  - After removal of residual effluent
  - After removal of fecal debris

### Aronchick Scale

- Assesses quality of preparation during initial inspection

<table>
<thead>
<tr>
<th>Points</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>5</td>
<td>Inadequate (repeat prep needed)</td>
</tr>
<tr>
<td>4</td>
<td>Poor (semisolid stool, &lt;90% of mucosa seen)</td>
</tr>
<tr>
<td>3</td>
<td>Fair (semisolid stool, &gt;90% of mucosa seen)</td>
</tr>
<tr>
<td>2</td>
<td>Good (clear liquid covering up to 25%, &gt;90% of mucosa seen)</td>
</tr>
<tr>
<td>1</td>
<td>Excellent (&gt;95% of mucosa seen)</td>
</tr>
</tbody>
</table>

### Ottawa Bowel Preparation Scale

- Assesses 3 colon segment scores that are summed and then a rating for amount of fluid in whole colon
- Scale from 0 (excellent) to 14 (very poor)

<table>
<thead>
<tr>
<th>Points</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>4</td>
<td>Inadequate (solid stool not cleared with washing and suctioning)</td>
</tr>
<tr>
<td>3</td>
<td>Poor (necessary to wash and suction to obtain a reasonable view)</td>
</tr>
<tr>
<td>2</td>
<td>Fair (necessary to suction liquid to obtain a reasonable view)</td>
</tr>
<tr>
<td>1</td>
<td>Good (minimal turbid liquid in segment)</td>
</tr>
<tr>
<td>0</td>
<td>Excellent (mucosal detail clearly visible)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Points</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>2</td>
<td>Large amount of fluid</td>
</tr>
<tr>
<td>1</td>
<td>Moderate amount of fluid</td>
</tr>
<tr>
<td>0</td>
<td>Small amount of fluid</td>
</tr>
</tbody>
</table>
Bowel Preparation Quality: Validated Scoring Systems

Boston Bowel Prep Score
- Assesses 3 colon segment scores after all cleansing maneuvers
- Overall total 0 to 9

<table>
<thead>
<tr>
<th>Points</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>Unprepared colon segment with stool that cannot be cleared</td>
</tr>
<tr>
<td>1</td>
<td>Portion of mucosa in segment seen after cleaning, but not all areas</td>
</tr>
<tr>
<td>2</td>
<td>Minor residual material after cleaning, but mucosa generally well seen</td>
</tr>
<tr>
<td>3</td>
<td>Entire mucosa well seen</td>
</tr>
</tbody>
</table>

- Score of 5 or higher associated with a 2% rate of recommending shorter surveillance intervals

Bowel Preparation Quality: Validated Scoring Systems

- Quite subjective
- Allows standardization
- Registry reporting (GIQuIC)
  - Excellent and good map to adequate
  - Fair and poor map to inadequate
- USMSTF and European Guidelines endorse evaluation after clearing fluid and residual material
- Learn one scale and use it

What is the Best Prep and How Do I Assess the Adequacy of the Prep

Summary

- The best prep is the one that gets done!!
- Bowel prep is a colonoscopy quality indicator
- Bowel preps must be individualized
  - Efficacy, cost, safety, tolerability
- Verbal counseling along with written instructions that are easy to follow
- Patients with predictors for poor preparation should get more intensive education and possibly more aggressive regimens
What is the Best Prep and How Do I Assess the Adequacy of the Prep

Summary

• Low residue or clear liquid diet in conjunction with an FDA approved bowel preparation
  – Use of a low volume bowel cleansing agent is associated with greater willingness to undergo repeat colonoscopy
    (US Multisociety Task Force on Colorectal Cancer)

• Split dose preps for all
  – Portion of preparation taken within 4-6 hours of test
  – Split dose cleansing is associated with greater willingness to repeat regimen
    (US Multisociety Task Force on Colorectal Cancer)

• Avoid sodium phosphate and magnesium citrate preparations in elderly or with renal disease

• Document quality of exam using a standard system that has been validated
  – USMSTF recommends use of scoring system after all efforts to clear residual debris completed
    • Does not recommend Aronchick or Ottawa scales

• Measurement of the rate of adequate colon cleansing should be conducted routinely
That’s All Folks