The Modern Bowel Preparation

*Seeing is Believing!*

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How often do you use a **split-dose** bowel preparation?

A. Never
B. Occasionally
C. Only for afternoon cases
D. Most of the time
E. All the time
Good Bowel Cleansing Is Key for High-Quality Colonoscopy

AGA SECTION

Optimizing Adequacy of Bowel Cleansing for Colonoscopy: Recommendations From the US Multi-Society Task Force on Colorectal Cancer

David A. Johnson,¹ Alan N. Barkun,² Larry B. Cohen,³ Jason A. Dominitz,⁴ Tonya Kaltenbach,⁵ Myriam Martel,² Douglas J. Robertson,⁶,⁷ C. Richard Boland,⁸ Frances M. Giardello,⁹ David A. Lieberman,¹⁰ Theodore R. Levin,¹¹ and Douglas K. Rex¹²
The Prep

• “The worse part of colonoscopy”
• “May it never fall into enemy hands”
• Taste: “goat spit and urinal cleanser”
• “Similar to a shuttle launch”
• “Commode should have a seat belt”
• Second dose: “Your bowels venture into the future and start eliminating food that you have yet to consume”

Colon Cleansing

The Achilles Heel of Colonoscopy
The Ideal Bowel Preparation

• Safe
• Effective
• Tolerable
• Palatable
• Easy to use
• Cheap
• Limited change in daily habits (food, work, etc.)
3 Criteria for Judging Bowel Preps

## Definitions of Adequate/Inadequate Prep

<table>
<thead>
<tr>
<th>Prep Quality</th>
<th>Operational</th>
<th>Conceptual</th>
<th>Clinical decision/management</th>
</tr>
</thead>
<tbody>
<tr>
<td>Adequate</td>
<td>Permits detection of all polyps &gt; 5mm</td>
<td>Exposes ≥ 90% mucosa</td>
<td>Allow guidelines for screening/surveillance to be followed</td>
</tr>
<tr>
<td>Inadequate</td>
<td>Unable to exclude polyps ≥ 5mm</td>
<td>Exposes &lt; 90% mucosa</td>
<td>Surveillance/re-screening intervals shortened</td>
</tr>
</tbody>
</table>

OR 18 (95% CI 12-28) for guideline-inconsistent recommendation for “fair” vs. excellent prep (75% vs. 15%)


## Consequences and Magnitude when Prep is Inadequate

<table>
<thead>
<tr>
<th>Consequences</th>
<th>Magnitude</th>
</tr>
</thead>
<tbody>
<tr>
<td>Longer cecal intubation</td>
<td>4 min</td>
</tr>
<tr>
<td>Longer withdrawal time</td>
<td>2 min</td>
</tr>
<tr>
<td>More difficult exam</td>
<td>Nearly 3 fold</td>
</tr>
<tr>
<td>↓ detection small adenomas</td>
<td>30-48%</td>
</tr>
<tr>
<td>↓ detection large adenomas</td>
<td>18-27%</td>
</tr>
<tr>
<td>Earlier repeat exams</td>
<td>Interval shortened by 30-70%</td>
</tr>
<tr>
<td>Increased cost</td>
<td>1% for every % exams requiring earlier repeat</td>
</tr>
</tbody>
</table>

Froehlich, GIE 2005; Chokshi, GIE 2012; Rex, AJG 2002; Ben-Horin, AJG 2007
A Priori Possibilities for Why Post-colonoscopy Colon Cancer Appear

- Biological variation in rates of growth of tumor
- Incomplete removal of polyps
- Technical limitation in detection
  - Hidden mucosa
  - Flat adenoma
- Inadequate bowel preparation
- Suboptimal examination technique

Rex DK. Am J Gastroenterol 2006;101(12):2866-2877.
# Types of Bowel Preps

<table>
<thead>
<tr>
<th>Type</th>
<th>Mechanism</th>
<th>Selected examples</th>
</tr>
</thead>
</table>
| PEG-based solutions         | High molecular weight non-absorbable polymers in a dilute, *osmotically-balanced* solution | • Fortrans®, KleanPrep®  
• MoviPrep® (PEG+Ascorbate)  |
| Osmotic laxatives           | ↑ intraluminal H₂O by promoting passage of extracellular fluid across the bowel wall | • Magnesium citrate  
• Sodium phosphate  
• Sodium sulfate  |
| Stimulant laxatives         | ↑ colonic smooth muscle activity  
↑ small intestinal secretion | • Senna, bisacodyl  
• Na picosulfate  |
| Combinations                | Stimulant + osmotic                                                       | • Na picosulfate + Mg citrate  
(Picoprep®, Citrafleet®)  |
Measuring Prep Quality: the Scales

- Aronchick - categorical
- Ottawa – ordinal → interval
- Boston – ordinal → interval
- Chicago – ordinal → interval
# Aronchick Scale

<table>
<thead>
<tr>
<th>Score</th>
<th>Findings</th>
</tr>
</thead>
<tbody>
<tr>
<td>Excellent</td>
<td>No fecal matter or nearly none in the colon; small amounts of clear liquid</td>
</tr>
<tr>
<td>Good</td>
<td>Small amounts of thin, liquid fecal matter seen and suctioned easily, mainly distal to splenic flexure; all mucosa seen</td>
</tr>
<tr>
<td>Fair</td>
<td>Moderate amounts of thick liquid to semisolid fecal matter seen and suctioned, including proximal to splenic flexure; small lesions may be missed; &gt;90% mucosa seen</td>
</tr>
<tr>
<td>Poor</td>
<td>Large amounts of solid fecal matter found, precluding a satisfactory study; unacceptable preparation; &lt;90% mucosa seen</td>
</tr>
</tbody>
</table>

Bowel Preparation Scales

**Excellently prepared (Excellent prep)**
- >90% of mucosa seen, mostly liquid stool, **minimal suctioning** needed for adequate visualization

**Goodly prepared (Good prep)**
- >90% of mucosa seen, mostly liquid stool, significant suctioning needed for adequate visualization

**Fairly prepared (Fair prep)**
- >90% of mucosa seen, mixture of liquid and semi-solid stool, which could be suctioned and/or washed

**Poorly prepared (Poor prep)**
- <90% of mucosa seen, mixture of semi-solid and solid stool, which could not be suctioned and/or washed
Boston Bowel Prep Scale (BBPS)

- Ten-point scale (0 to 9) assesses prep quality after all cleaning maneuvers are completed.
- Points of 0 → 3 applied to 3 segments:
  - Ascending
  - Transverse colon and flexures
  - Descending, sigmoid, and rectum
- Score ≥ 2 in all 3 segments = operational definition of “adequate”
- Segments with a BBPS score of 1 have a significantly higher rate of missed adenomas >5 mm than segments with scores of 2 or 3 (15.9% vs. 5.6% for score 1 vs. 3, p<0.05)

Key Concept #1

Split the prep!
A Randomized Single-Blind Trial of Whole vs. Split-Dose Prep +/- Dietary Restriction

Day -1

Day 0

Split Dosing Provides more Satisfactory Results than Traditional Dosing

“Although several commercial bowel preparations are available, certain principles of preparation will enhance the effectiveness of each of these commercial preparations. **Best established is the principle of “splitting,”** in which at least half of the preparation is given on the day of the colonoscopy.”
Intestinal Chyme: No Food Required!
Full vs. Split-Dose

## Split-Dose vs. Full-Dose PEG

<table>
<thead>
<tr>
<th>Outcome</th>
<th>Total N</th>
<th>Subject N</th>
<th>Odds Ratio (95% CI)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Satisfactory prep</td>
<td>4</td>
<td>929</td>
<td>3.70 (2.79-4.91)</td>
</tr>
<tr>
<td>Discontinued prep</td>
<td>3</td>
<td>733</td>
<td>0.53 (0.28-0.98)</td>
</tr>
<tr>
<td>Willing to repeat</td>
<td>2</td>
<td>300</td>
<td>1.76 (1.06-2.91)</td>
</tr>
<tr>
<td>Nausea</td>
<td>-</td>
<td>-</td>
<td>0.55 (0.38-0.79)</td>
</tr>
</tbody>
</table>

*No difference in bloating, cramping, sleep disturbance*

Split Dosing Improves Adenoma Detection Rates in Patients with Positive FIT tests

SSP=Sessile serrated polyp

Prep to Colonoscopy Interval and Prep Quality

PC Interval:

No. of patients:

≤ 3 hr  3 ~ 4 hr  4 ~ 5 hr  5 ~ 6 hr  6 ~ 7 hr  7 ~ 8 hr  > 8 hr
68   58   51   35   53   62   39

Ottawa score (Total colon)

5.08  4.25  4.70  5.11  4.86  5.20  5.92

P=0.02*  P=0.24  P=0.055  P=0.02*  P=0.08  P<0.001*

Is Split-Dosing an Option for AM Colonoscopy?

- American Society of Anesthesiologists → ingestion of clear liquids until 2 h before sedation does not affect residual gastric volume
- Ingestion of bowel cleansing agents on day of colonoscopy did not affect residual gastric volumes
- In a survey conducted in 2008, 83% of patients were willing to wake up as early as 3 AM to take the second dose if the prep quality would be better

Uptake of Split-Dose Prep and Colonoscopy Appointment Time

\[ \chi^2 \text{ for linear trend } 277.844, \ p < 0.001 \]

Key Concept #2

Improve the taste (and volume) to enhance tolerability
"Wow, this prep is so delicious, I think I'll drink another!"

...said no one ever
Menthol Candy Improves Palatability of PEG-ELS

Menthol Candy and Split-Dose 4L PEG

Split-dose Menthol-Enhanced PEG versus PEG-Ascorbic Acid (MoviPrep®)

Dual Action Low-Volume Prep

CitraFleet®
Powder for oral solution in sachet
Sodium Picosulfate, Light Magnesium Oxide, Citric Acid Anhydrous

Promotes evacuation of the bowel by stimulating bowel movements and increasing water content in the stool.

2 sachets

 PICOPREP®
Split-dose P/MC superior to day-before dosing with 2L PEG-3350 and bisacodyl

**Split-dose administration of a dual-action, low-volume bowel cleanser for colonoscopy: the SEE CLEAR I study**

Douglas K. Rex, MD,1 Philip O. Katz, MD,2 Gerald Bertiger, MD,3 Stephen Vanner, MD, FRCP,4 Lawrence C. Hookey, MD, FRCP,5 Vivian Alderfer, PhD,5 Raymond E. Joseph, MD5

Indianapolis, Indiana; Philadelphia, Flourtown, North Wales, Pennsylvania, USA; Kingston, Ontario, Canada; Parsippany, New Jersey, USA


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P/MC was non-inferior to 2L PEG-3350 and bisacodyl

**A Dual-Action, Low-Volume Bowel Cleanser Administered the Day Before Colonoscopy: Results From the SEE CLEAR II Study**

Philip O. Katz, MD1, Douglas K. Rex, MD2, Michael Epstein, MD, FACP, AGAF3, Nav K. Grandhi, MD4, Stephen Vanner, MD, FRCP,5 Lawrence C. Hookey, MD, FRCP,5 Vivian Alderfer, PhD5 and Raymond E. Joseph, MD5

How easy or difficult was it to consume the prescribed bowel preparation?

- Very easy
- Difficult
- Easy
- Very difficult

P/MC (n=293)
PEG-3350 + bisacodyl tablets (n=298)

Please describe your overall experience with the prescribed bowel preparation.

- Excellent
- Poor
- Good
- Bad

Would you ask your doctor for this preparation again if you need another colonoscopy in the future?

- Yes
- No

Sensory Characterization of Bowel Cleansing Solutions

Sensory Characterization of Bowel Cleansing Solutions

Table 1. Least squares means of acceptability variables (rated using the 9-point hedonic scale) for the bowel cleansing laxative solutions

<table>
<thead>
<tr>
<th>Acceptability Variable</th>
<th>Bowel cleansing laxative solution</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>PEG-Asc</td>
</tr>
<tr>
<td></td>
<td>Mean ± SD</td>
</tr>
<tr>
<td>Overall acceptability</td>
<td>3.8 ± 2.1^a</td>
</tr>
<tr>
<td>Odor</td>
<td>5.5 ± 2.1^ab</td>
</tr>
<tr>
<td>Taste</td>
<td>3.5 ± 2.1^b</td>
</tr>
<tr>
<td>Mouthfeel</td>
<td>4.2 ± 1.9^b</td>
</tr>
</tbody>
</table>

SD: Standard Deviation
^a,b,c Means with different superscripts are significantly different (p<0.05)

Dietary modification is an important and critical component of low-volume preparations
Dietary Modifications Necessary with Low Volume Preps

Day -3 and -2

Day -1
The Use of a Customized Mobile Smartphone App in Colonoscopy Preparation

The Use of a Customized Mobile Smartphone App in Colonoscopy Preparation

The Use of a Customized Mobile Smartphone App in Colonoscopy Preparation

Key Concept #4

Customize the prep

Talk to your patient!
# Predictors of Inadequate Bowel Preparation for Colonoscopy

<table>
<thead>
<tr>
<th>Medical factors</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chronic constipation/laxative use or dependence</td>
</tr>
<tr>
<td>Use of constipating medications, especially opioids and tricyclics</td>
</tr>
<tr>
<td>Long standing diabetes mellitus</td>
</tr>
<tr>
<td>Obesity</td>
</tr>
<tr>
<td>Prior resection of the colon</td>
</tr>
<tr>
<td>Prior inadequate preparation for colonoscopy</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Other patient factors</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lower educational level</td>
</tr>
<tr>
<td>Low health literacy</td>
</tr>
<tr>
<td>Low patient activation</td>
</tr>
</tbody>
</table>

Care should be taken when using low-volume osmotic preps in patients with kidney disease, heart failure, low seizure threshold or significant comorbidities.

Take Home Points

• High quality bowel prep is necessary for high-quality colonoscopy and is an important quality indicator
• Suboptimal prep results in significant detrimental effects
• **Split the dose** regardless of prep whenever possible
• Split-dose 4-L PEG is reference standard
  – Safest but *large volume/taste remain strong impediments*
  – Alternatives work equally well for non-constipated patients and are better tolerated because of low volume and good taste
  – Give clear instructions and stress adherence by *explaining consequences of non-adherence*

**DO IT!**
Colonoscopy
Don’t sweat the prep

Getting started ... Schedule it!
Clinic will provide instructions

Day before exam ...
- Pick up prep items
- Begin prep at appointed time
- Follow all instructions
- Clear liquids only - have a popsicle!
- Stay near your throne
- Relax as usual
- Nothing to eat/drink after midnight

Morning of exam ...
- Cheers to your health!
- Your driver takes you home after short recovery
- Colonoscopy takes about 30 minutes
- Nurse takes vital signs and gives meds to make you sleepy
- Change into comfy gown
- Don’t be tardy for the exam
- Continue prep - you’re almost done!