Colonoscopy Preparation

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2011
Colon Preparation

Purpose

• Improve Visualization:
  - Remove stool from lumen and wall.
  - Avoid obscuring of lenses/ camera and light beam.
  - Minimize “missed lesion rate”.

• Remove hydrogen, methane, and other explosive gasses.

• Shorten procedure time.

• Limit Costs.
• Clinical Outcomes Research Initiative database.
• Retrospective
• Subjects: 93004
• 01/01/2000-12/31/2001
• Adequate (76.9%) vs Inadequate prep (23.1%)
• Larger lesions detected equally. Some small lesions missed.
Bowel Prep vs Efficiency and Cost
Rex et al. Am J Gastroenter 2002;97:1696-1700

• Compared ideal prep vs observed in:
  – Private Hospital (1) w. 13.5% poor prep
  – Public Hospital (2) w. 26.5% poor prep

• Observed frequency of:
  - aborted exams,
  - exams repeated early
  - cost increase.
Risk of Explosive Gases

- Fatal Colonic Explosion after colon prep with Mannitol (Bigard et al. Gastroenterology 1979;77:1307-10)
- Colon explosion with perforation after APC treatment in unprep colon (enemas only) (Soussan et al. Gastrointest Endosc 2003;57:412-3)
- REMEMBER: Use of Lactulose or Sorbitol can cause flammable gases.
Instruments and Risk of Explosion

**RISKY:**
- Monopolar Electrocautery (“hot” snare & “hot” biopsy)
- Bipolar Electrocautery (BICAP)
- Argon Plasma Coag.
- Laser

**NOT RISKY:**
- Biopsy and “cold” snare
- Heater Probe
- Injection hemostasis
- Endo-loop
- Hemo-clip
- Band-ligation
Conclusions

• Poor colonoscopy prep increases risk of missed polyps.
• Poor colonoscopy prep increases cost by increasing the number of aborted exams and early re-examinations.
• Poor colonoscopy prep and use of fermentable carbohydrates (sorbitol, lactulose, mannitol) increase risk of colonic explosion.
Methods for Colon Preparation

• Two day clear-liquid diet + 300 ml Mg Citrate @ pm + tap water enemas until clear 2 h before exam.
• One day clear-liquid diet + Senna 150 mg @ noon and again at 6 pm.
• Iso-osmotic colon irrigation (Saline lavage or PEG-balanced solutions).
• Hypertonic saline solutions (NaP, Mg Citrate)
Oral Colon Irrigation Solutions

- Work by flushing the colon with large volume of clear fluid.
- Based in principle that small bowel contents have to remain isotonic to plasma, hence, non-absorbable solutes will draw a “mandatory volume” to the cecum to keep isotonicity.
- Suprep, in two 6 oz bottles has: 492 mEq Na, 72 mEq K, 26 mmol Mg, 898 mOsm.
<table>
<thead>
<tr>
<th>Preparation Solution</th>
<th>Osmolality</th>
</tr>
</thead>
<tbody>
<tr>
<td>NuLytely or Golytely</td>
<td>1160 mOsm/4 L</td>
</tr>
<tr>
<td>NuLytely or Golytely</td>
<td>870 mOsm/3 L</td>
</tr>
<tr>
<td>Fleet Phosphosoda</td>
<td>807 mOsm/90 mL</td>
</tr>
<tr>
<td>Visicol</td>
<td>820 mOsm/40 tab</td>
</tr>
<tr>
<td>Visicol</td>
<td>660 mOsm/32 tab</td>
</tr>
<tr>
<td>Visicol</td>
<td>575 mOsm/28 tab</td>
</tr>
<tr>
<td>Mg Citrate</td>
<td>720 mOsm/900 mL</td>
</tr>
<tr>
<td>Mg Citrate</td>
<td>480 mOsm/600 mL</td>
</tr>
<tr>
<td>Suprep 12 onz</td>
<td>898 mOsm/336 mL</td>
</tr>
</tbody>
</table>
Fluid needs for Iso-tonicity (fluid deficit) in mL

- Nulytely or Golytely (any volume) = 0
- Fleet Phosphosoda 90 mL = 2690
- Visicol 40 tabs = 2820
- Visicol 32 tabs = 2275
- Visicol 28 tabs = 1980
- Mg Citrate 900 mL = 1582
- Mg Citrate 600 mL = 1055
- Suprep 12 onz (336 mL) = 2760
Volume Presented to Cecum

- NuLytely or GoLytely 4L \(4000 \text{ mL}\)
- NuLytely or GoLytely 3 L \(3000 \text{ mL}\)
- Fleet Phosphosoda 90 mL \(2780 \text{ mL}\)
- Visicol 40 tablets \(2820 \text{ mL}\)
- Visicol 32 tablets \(2275 \text{ mL}\)
- Visicol 28 tablets \(1980 \text{ mL}\)
- Mg Citrate 3 x 300mL \(2480 \text{ mL}\)
- Mg Citrate 2 x 300 mL \(1655 \text{ mL}\)
- Suprep 12 onz (336 mL) \(3096 \text{ mL}\)
Contraindications of Oral Colon Irrigation Solutions

- **Na Phosphate**
  - GI obstruction
  - Gastric retention
  - Bowel perforation
  - Toxic colitis
  - Ileus
  - Megacolon
  - Ascites
  - Heart failure
  - Impaired renal function
  - Electrolyte imbalance
  - Debilitated condition

- **PEG-balanced**
  - GI obstruction
  - Gastric retention
  - Bowel perforation
  - Toxic colitis
  - Ileus
  - Hypersensitivity
Oral Irrigation Solutions

Conclusions

• Iso-osmotic solution need little or no additional fluid ingestion.

• Hypertonic solutions require ingestion of substantial amounts of fluids to avoid dehydration.

• Na Phosphate has additional contraindications in heart failure, kidney disease, electrolyte disorders, ascites, megacolon and inability to drink extra fluids (debilitated).
Single Preparation as in “paper insert”
PEG vs Phosphosoda
Meta-analysis
(Hsu et al. Gastrointest Endosc 1998;48:276-82)

- Meta-analysis of 8 trials, 1286 subjects
- Phosphosoda in split-dose (one or two day)
- PEG solution in single dose
PEG vs Visicol


- Prospective & randomized.
- Visicol 20 tab + 1680 ml water @ 6 pm and same repeat in am, vs
- NuLytely 4 L @ 6 pm
Fleet Phosphosoda vs Visicol
Balaban et al. Gastrointest Endosc 2003;57:AB102

- Prospective, randomized.
- Phosphosoda 45 ml@ pm + 45 ml @ am, vs
- Visicol 20 tab @ pm + 20 tab @ am, vs
- Visicol 14 tab @ pm + 14 tab @ am
Conclusion

• If used as in “paper insert”, colonoscopy prep with liquid Phosphosoda gives better cleansing than with Visicol, and preparation with Visicol gives better cleansing than with PEG-balanced solutions.
Timing vs Quality of Preparation
Timing vs Quality of Prep
Belkelhammer et al Gastrointest Endosc 2002;56:89-94

- Prospective, randomized
- All patients on clear liquids + plenty of fluids
- Na P: 45 ml + 45 ml -10am/7pm vs -7pm/6am)
- Mg Citrate: 300 ml + 300 ml + 300 ml (10am/2pm/6pm)
Timing vs Quality of Prep
ElSayed et al. Gastrointest Endosc 2003;58:36-40

- Prospective, randomized
- Clear liquid diet day before, then NPO
- PEG solution
  - 3 L @ 6 pm vs
  - 2 L @ 6 pm + 1 L @ am
Timing vs Quality of Prep
Ell et al. Endoscopy 2003;35:300-304

- Prospective, randomized
- Clear liquid lunch & dinner + plenty fluids
- **Golytely** 3 L pm + 1 L @ 6 am, vs
  **Nulytely** 2 L pm + 1 L @ 6 am, vs
  **NaP** 45 ml pm + 45 ml @ am
- Categorized by worst cleansed segment.
Timing vs Quality

Conclusions

• In Phosphosoda Prep: a two-day evening and morning dose is superior to the one-day morning and evening dose.
• In PEG Prep: a two-day evening and morning split-dose is superior to the one-day evening dose.
• A two-day Split dose PEG Prep (3 L or 4 L) is superior to the two-day split-dose Phosphosoda prep.
• A 3-dose, one-day Mg Citrate Prep is superior to the two-day Phosphosoda Prep.
Volume vs Quality of Prep
Volume vs Quality of Prep
Ell et al. Endoscopy 2003;35:300-304

- Prospective, randomized
- Clear liquid lunch & dinner + plenty fluids
- Golytely 4 L (3 L pm + 1 L @ 6 am), vs Nulytely 3 L (2 L pm + 1 L @ 6 am), vs
Volume vs Quality of Prep

- Prospective, randomized
- Clear liquid lunch & dinner; NPO p MN.
- **Nulytely 4 L @ 6pm**
- **Bisacodyl (Dulcolax) 20 mg @ noon + Nulytely 2L @ 6 pm**
Volume vs Quality of Prep

4-Liter PEG vs 2-Liter PEG + MgCitrate or Dulcolax
Sharma et al. Gastrointest Endosc 1998;47:167-71

• Prospective and randomized.
• Colyte 4-L one-day @ 4 pm, vs
• MgCitrate 300 ml @ 4 pm + 2-L Colyte @ 5 pm, vs
• Bisacodyl 20 mg @ 4 pm + Colyte 2-L @ 4 pm.
Volume vs. Quality of Prep
Balaban et al. Gastrointest Endosc 2003;57:AB102

- Prospective, randomized.
- **Visicol 20** tab @ 6 pm and **20** tab in am, vs
- **Visicol 14** tab @ 6 pm and **14** tab in am.

![Graph showing comparison of good/excellent results between two groups, one with 20 tabs of Visicol and another with 14 tabs of Visicol.](image-url)
Volume vs Quality of Prep

Conclusions

- PEG 4 Liters is superior to 3 Liters (volume of flow)
- Pre-treatment with Mg Citrate or Bisacodyl, makes 2-Liter of PEG prep equivalent to 4-Liters of PEG alone (force of the flow).
- Visicol 28 tablets is equivalent or better than 40 tablets.
Safety
Safety of Na Phosphate vs PEG Preparations

Hookey et al. Gastrointest Endosc 2002;56:895-902
Beloosesky et al. Arch Int Med 2003;163:803-808

• Frequency of asymptomatic orthostatic hypotension similar to PEG prep.

• Serum $K^+$ mean-drop: 0.4 mEq/L in NaP vs 0.1 with PEG. In 13 to 25%, $K^+$ < LLN. In the elderly, 56% had hypo-kalemia.

• Serum $Ca^{++}$ mean drop: 0.05-0.15 mEq/L with NaP vs 0-0.02 with PEG. In 6-11% $Ca^{++}$ <LLN; in 44% i$Ca^{++}$ < LLN; none with symptoms. In the elderly, 58% had hypo-calcemia.
Adverse Events of Na Phosphate in Colonoscopy Prep (Adults)
Hookey et al. Gastrointest Endosc 2002;56:895-902

- **Six** hemodynamic and electrolyte disorders with *proper use* (hypovolemia, hypokalemia, hypernatremia, hypocalcemia, ischemic colitis).
- **Four** seizure due to electrolyte disorders, with *proper use*.
- **Two** fatal hyperP & ARF due to *high dose*.
- **Five** hemodynamic, electrolyte, and renal disorders due to *high dose*.
Gatorade + Phosphosoda
Barclay et al. Gastrointest Endosc 2002;56:633-8

- Prospective, randomized.
- Phosphosoda 45 ml @5 pm & 10 pm + clear liquids all day.
- Gatorade 3.8 L vs Clear liquids 3.8 L.
- Drop in Syst BP
- Quality of Prep.
Phosphosoda and Aphthous Colonic Ulcers
Berkelhammer et al. Gastrointest Endosc 2002;56:89-94

- In 5.5% of patients.
- Small, 1-3 mm, erythematous halo, non-confluent, discrete, over normal mucosa.
- Most common in rectosigmoid.
- Independent of timing of doses (9 vs 11 hours apart)
- Diagnostic confusion in 40% of them.
- Pathology shows mucosal disruption with lymphoid aggregates.
Safety

Conclusions

• When used properly in healthy patients, all colon preps are safe.
• Na Phosphate causes hypo-kalemia and hypo-calcemia in more than half of elderly patients.
• Na Phosphate should not be used in patients with significant cardiac, renal, or liver disease, nor in the debilitated. Also avoid them in patients taking ACE inh., ARBs & NSAIDs.
• Gatorade decreases NaP-induced volume-depletion and improves prep quality.
• Aphthous-like lesions can occur with NaP prep, which can cause confusion with IBD.
**Some Equivalent Preps**  
*(expected > 90% Good/Excellent)*

<table>
<thead>
<tr>
<th>Breakfast, day before Exam</th>
<th>Noon, day before Exam</th>
<th>6 PM, day before exam</th>
<th>AM of Exam-day (finish 3h before leaving home)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Regular</td>
<td>Clear liquid diet</td>
<td>[PEG 3L or PEG 2 L] + Bisacodyl 20 mg + clear liquids</td>
<td>PEG 1 L</td>
</tr>
<tr>
<td>Regular</td>
<td>Clear liquid diet</td>
<td>[PEG 4 L or PEG 2 L] + Bisacodyl 20 mg + clear liquids</td>
<td>Mg Citrate 300 ml + Gatorade 16 oz</td>
</tr>
<tr>
<td>Regular</td>
<td>Clear liquid diet</td>
<td>NaP 45 ml + Gatorade 2.85 L (3 Qt = 96 oz or 12 glass)</td>
<td>NaP 45 ml + Gatorade 48 oz (1.5 Qt = 48 oz or 6 glass)</td>
</tr>
<tr>
<td>Regular</td>
<td>Clear liquid diet &amp; Mg Citrate 300 ml + Gatorade 48 oz</td>
<td>Mg Citrate 300 ml + Gatorade 48 oz (6 glass)</td>
<td>Mg Citrate 300 ml + Gatorade 16 oz (2 glass)</td>
</tr>
<tr>
<td>Regular</td>
<td>Clear liquid diet</td>
<td>Suprep (6 oz + 10 oz water) + clear liquids 88 oz (11 glass)</td>
<td>Suprep (6 oz + 10 oz water) + clear liquids 40 oz (5 glass)</td>
</tr>
</tbody>
</table>

The volume of Gatorade in the 1st day covers needs for insensible losses & urine output.
My Conclusions

- Colon Preps work better when they are divided in two-days, with a PM + AM dose.
- Clear-liquid diet should start at least at lunch time on day before exam.
- AM dose in second day, should be ingested completely at least 3 hours before leaving home.
- When taking NaP (90 mL) prep, 3-4 Qt of Gatorade decreases volume depletion.
- Poor preps increase the cost of colonoscopy, and “missed lesion rate”.