

Colonoscopy Preparation

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Colon Preparation

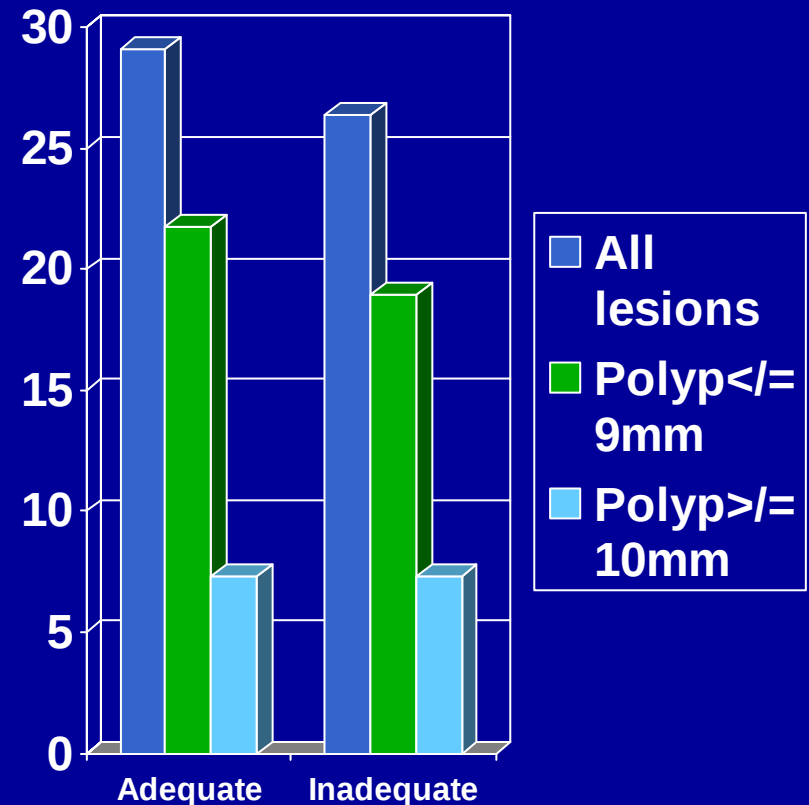
Purpose

- 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.

Prep Quality vs Neoplasia Detection

Harewood et al. Gastrointest Endosc 2003;58:76-9

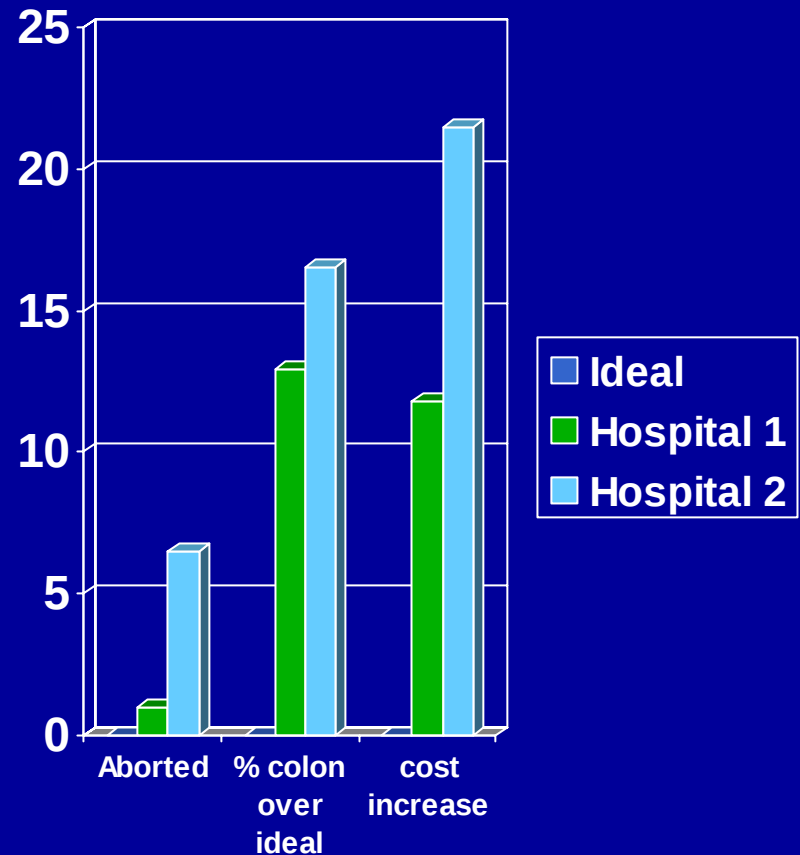
- Clinical Outcomes Research Initiative database.
- Retrospective
- Subjects: 93004
- 01/01/2000-12/31/2001
- Adequate (76.9%) vs Inadequate prep (23.1%)
- ***Larger lesions detected equally. Some small lesions missed.***



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.

Osmolar Loads of Colon-Preparation Solutions

- *NuLytely or Golytely* = 1160 mOsm/ 4 L
- *NuLytely or Golytely* = 870 mOsm/ 3 L
- *Fleet Phosphosoda* = 807 mOsm/ 90 mL
- *Visicol* = 820 mOsm/ 40 tab
- *Visicol* = 660 mOsm/ 32 tab
- *Visicol* = 575 mOsm/ 28 tab
- *Mg Citrate* = 720 mOsm/ 900 mL
- *Mg Citrate* = 480 mOsm/ 600 mL
- *Suprep 12 onz* = 898 mOsm/ 336 mL

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 mL |
| • NuLytely or GoLytely 3 L | 3000 mL |
| • Fleet Phosphosoda 90 mL | 2780 mL |
| • Visicol 40 tablets | 2820 mL |
| • Visicol 32 tablets | 2275 mL |
| • Visicol 28 tablets | 1980 mL |
| • Mg Citrate 3 x 300mL | 2480 mL |
| • Mg Citrate 2 x 300 mL | 1655 mL |
| • Suprep 12 onz (336 mL) | 3096 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).

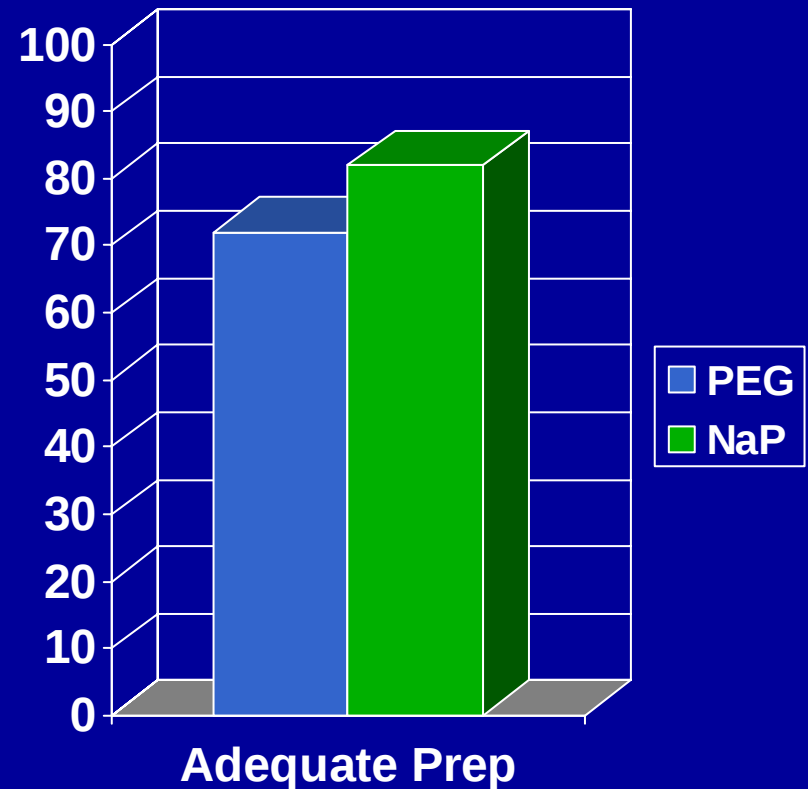
***Single Preparation as in “paper
insert”***

PEG vs Phosphosoda

Meta-analysis

(Hsu et al. Gastrointest Endosc 1998;48:276-82)

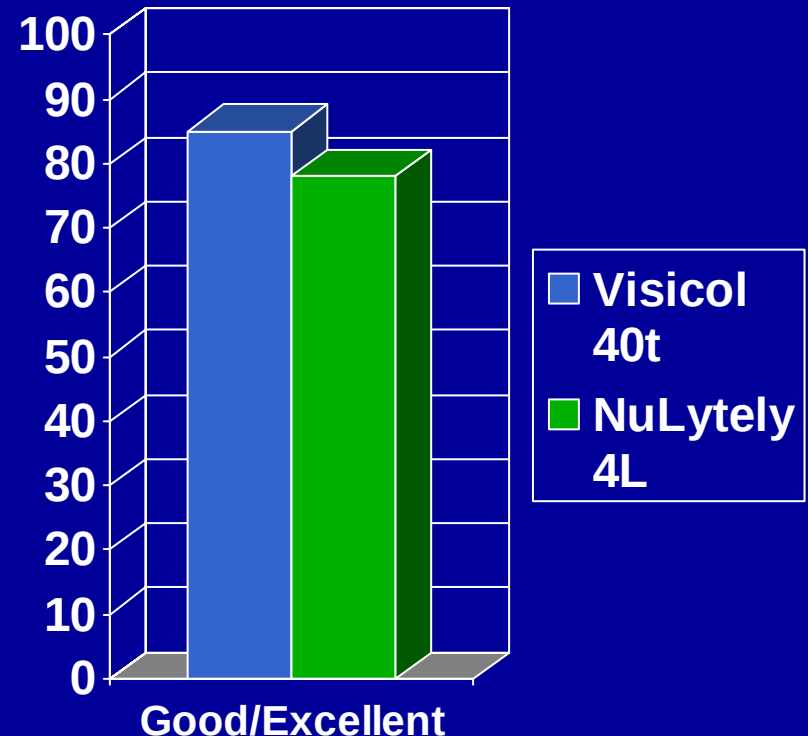
- Meta-analysis of 8 trials, 1286 subjects
- Phosphosoda in split-dose (one or two day)
- PEG solution in single dose



PEG vs Visicol

Kastenberg et al. Gastrointest Endosc 2001;54:705-13

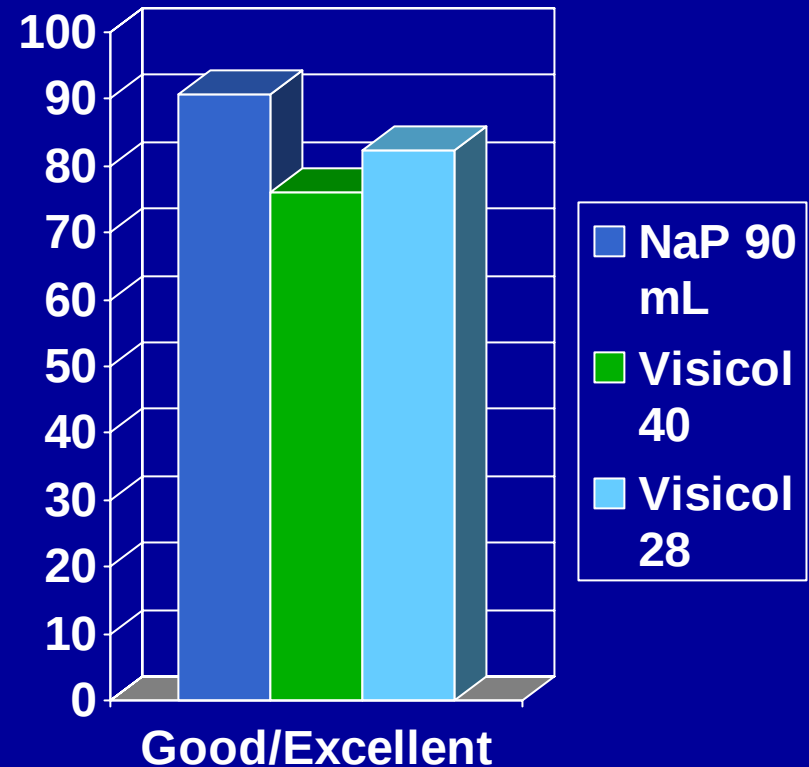
- Prospective & randomized.
- Visicol 20 tab + 1680 ml water @ 6 pm and same repeat in am, vs
- NuLytely 4 L @ 6 pm



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

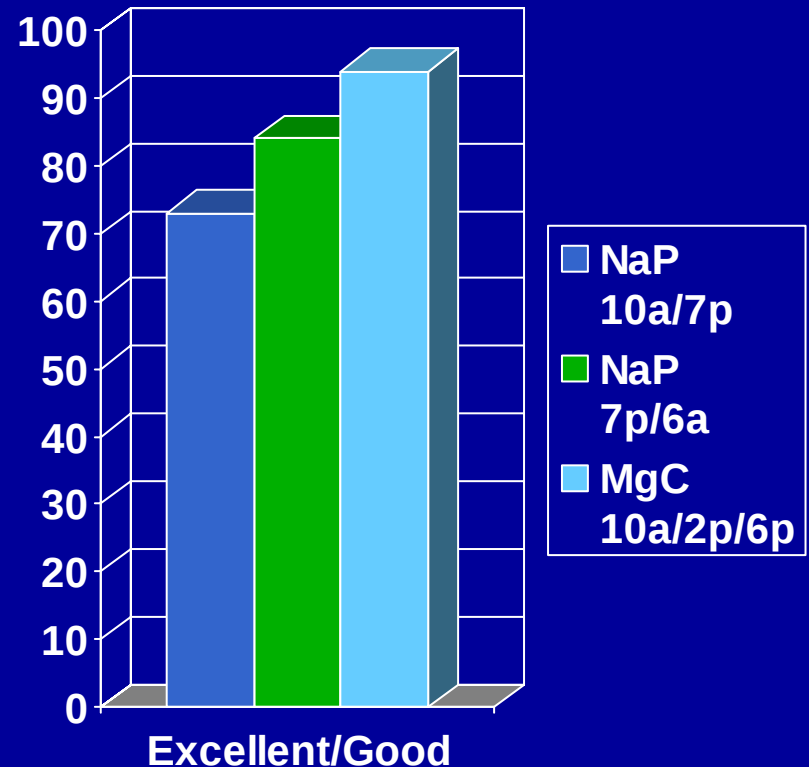
- If used as in “paper insert”, colonoscopy prep with liquid Phosphosoda gives better cleansing than with Visicol, and preparation with Visicol gives better cleansing than with PEG-balanced solutions.

Timing vs Quality of Preparation

Timing vs Quality of Prep

Belkelhammer et al Gastrointest Endosc 2002;56:89-94

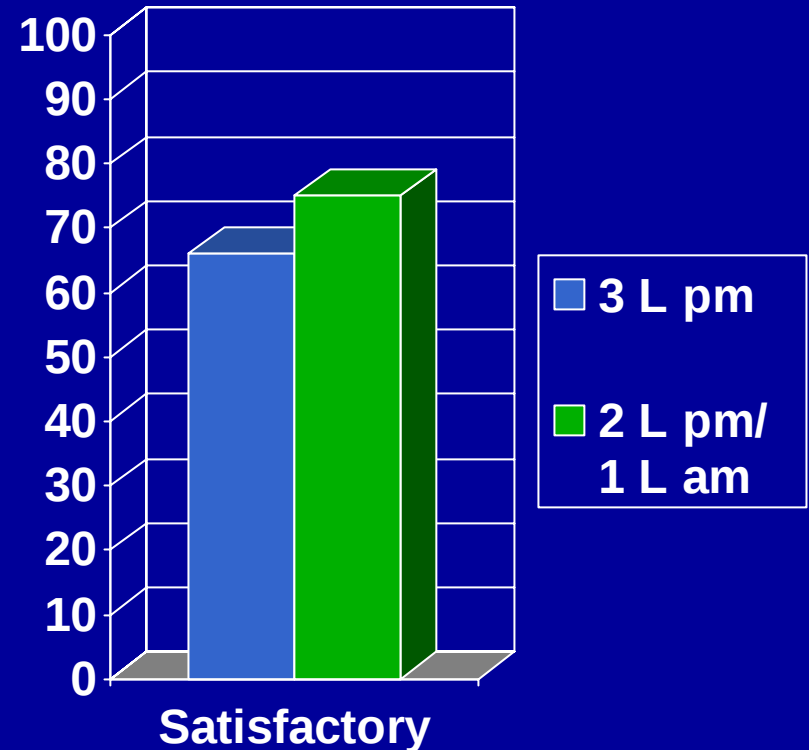
- Prospective, randomized
- All patients on clear liquids + plenty of fluids
- Na P: 45 ml + 45 ml
-10am/7pm vs
-7pm/6am)
- Mg Citrate: 300 ml + 300 ml + 300 ml
(10am/2pm/6pm)



Timing vs Quality of Prep

ElSayed et al. Gastrointest Endosc 2003;58:36-40

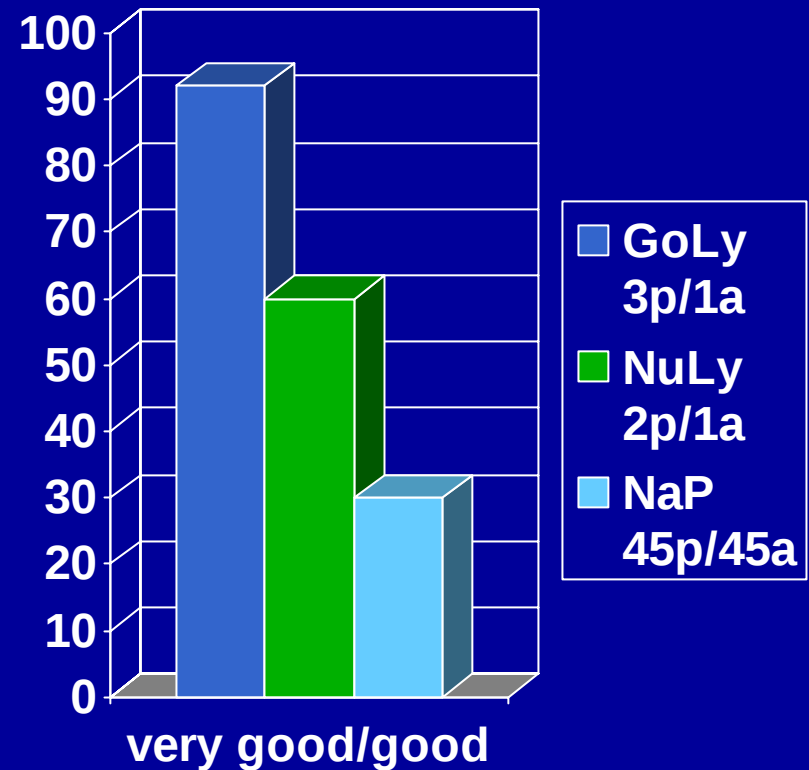
- Prospective, randomized
- Clear liquid diet day before, then NPO
- PEG solution
 - 3 L @ 6 pm vs
 - 2 L @ 6 pm + 1 L @ am



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

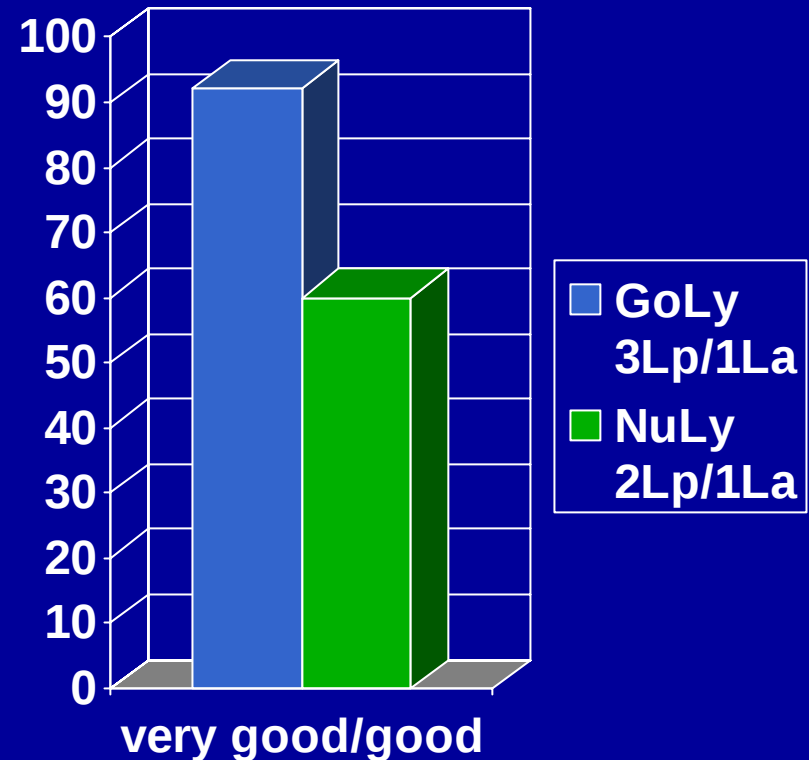
- In Phosphosoda Prep: a two-day evening and morning dose is superior to the one-day morning and evening dose.
- In PEG Prep: a two-day evening and morning split-dose is superior to the one-day evening dose.
- A two-day Split dose PEG Prep (3 L or 4 L) is superior to the two-day split-dose Phosphosoda 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

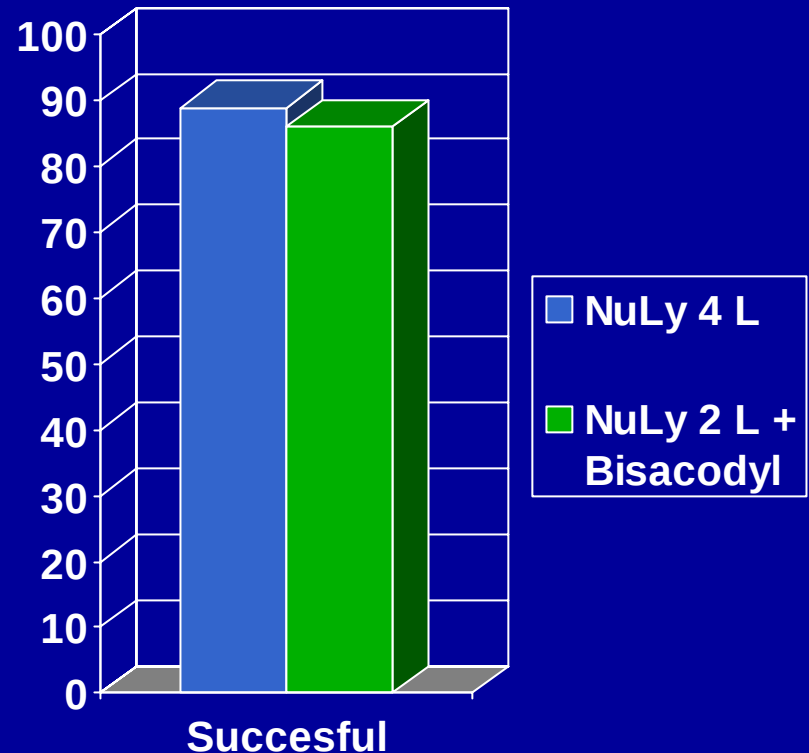
- Prospective, randomized
- Clear liquid lunch & dinner + plenty fluids
- **Golytely 4 L** (3 L pm + 1 L @ 6 am), vs **Nulytely 3 L** (2 L pm + 1 L @ 6 am), vs



Volume vs Quality of Prep

DiPalma et al. Am J Gastroenterol 2003;98:2187-2191

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

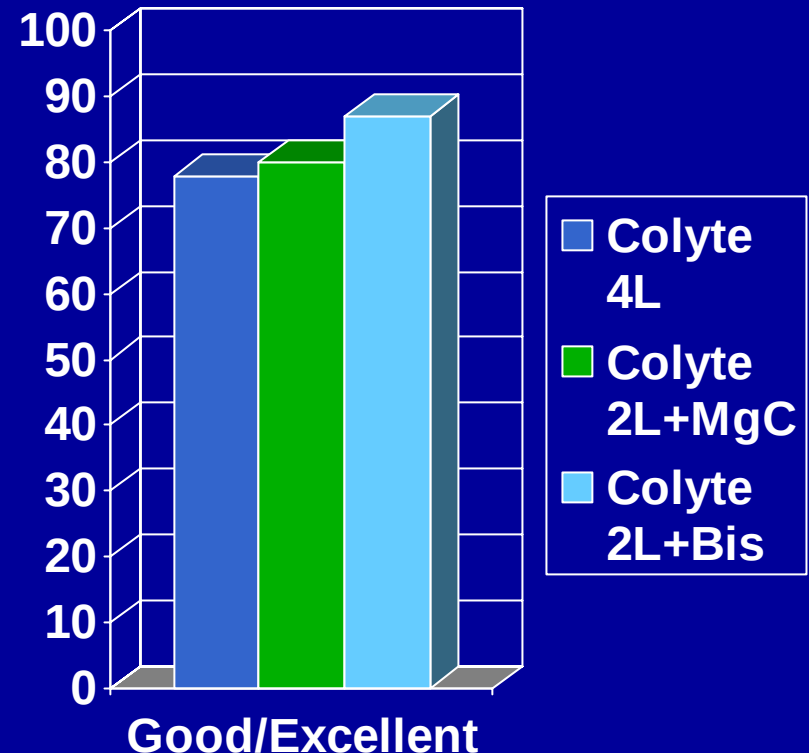


Volume vs Quality of Prep

4-Liter PEG vs 2-Liter PEG + MgCitrate or Dulcolax

Sharma et al. Gastrointest Endosc 1998;47:167-71

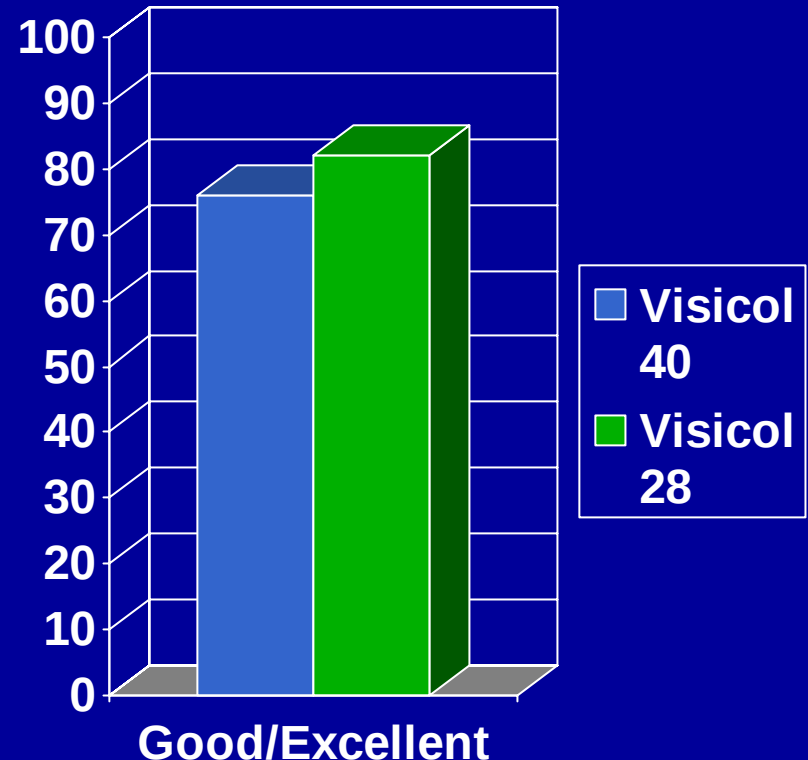
- Prospective and randomized.
- **Colyte** 4-L one-day @ 4 pm, vs
- **MgCitrate** 300 ml @ 4pm + 2-L Colyte @ 5 pm, vs
- **Bisacodyl** 20 mg @ 4 pm + **Colyte** 2-L @ 4 pm.



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.



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% $iCa^{++} < LLN$; none with symptoms.
In the elderly, 58% had hypo-calcemia.

Adverse Events of Na Phosphate in Colonoscopy Prep (Adults)

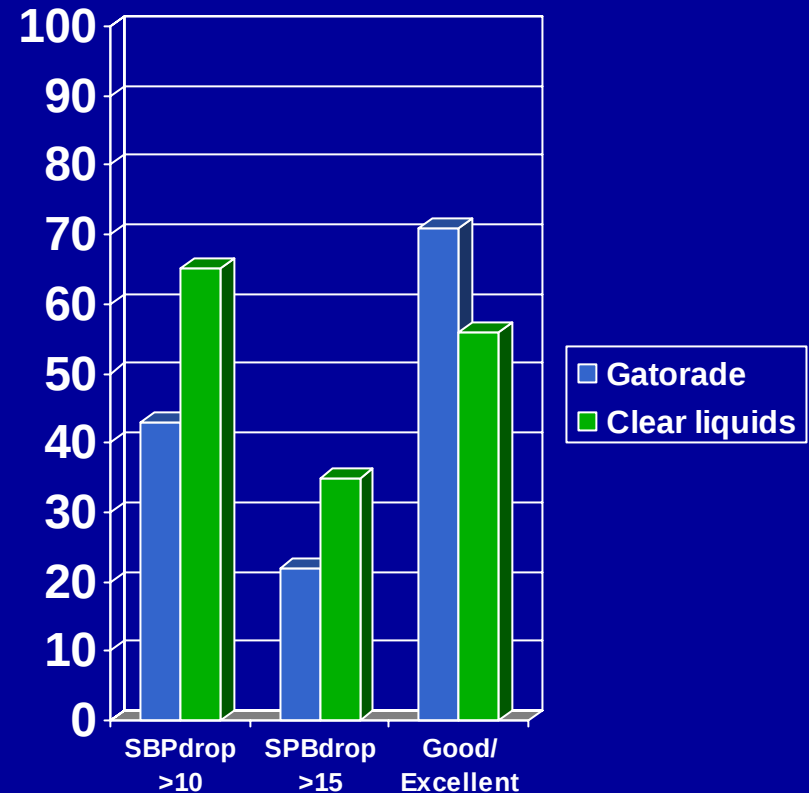
Hookey et al. Gastrointest Endosc 2002;56:895-902

- **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**.
- Increased risk of “phosphate nephropathy” in patients taking ACE inh., ARBs & NSAIDs (Am J Nephrol 2005;16:3389-96).

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)

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

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”.