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London, UK
Bowel preparation is crucial for a QUALITY EXAMINATION.

- **GOOD BOWEL PREPARATION**
  - **Optimal examination technique**
    - **Anti-spasmodic**
      - **CO$_2$ insufflation**
    - **IMAGING TECHNOLOGY**
Bowel preparation is important for the endoscopist!

- **Poor Preparation**
  - 10% all colonoscopies
  - 1/5 failed colonoscopies*
  - longer, more difficult procedures
  - more likely incomplete**
  - reduced polyp detection***
  - disrupted schedules
  - loss of efficiency
  - loss of income

* BSG audit of colonoscopy practice Gut 2004
** Froehlich et al. European multi-centre audit of colonoscopy. GIE 2005
*** Sherer et al. GIE 2012
Bowel preparation is important for the patient!

- the colonoscopy was easy …
- but the bowel preparation was terrible! “

- days off work
- bad taste
- made me sick
- tummy hurt
- no sleep
- sore bottom

But …… “at least I’ve lost weight doctor!”
Should we use the scales?

**YES** we should record quality of bowel preparation

Quality indicator - for **audit** and **service improvement**
Boston Bowel Prep Scale

- Validated scale
- CORI database
- Segmental scoring 0-3, max score = 9
- Right, transverse, left colon
- After washing

www:cori.org/bbps/

Lai et al. GIE 2009

The Boston University School of Medicine

Brian Saunders, MD

has participated in the enduring material titled
The Boston Bowel Preparation Scale Educational Program

and is awarded 0.5 ANA PMA Category 2 Credits™.

Date Completed: April 30, 2013
Maximum Credits: 0.5
Total Credits Reported: 0.5

Score: 75%

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Risk Management: This program meets the criteria of the Massachusetts Board of Registration in Medicine for risk management study.

Jerry M. Mannix, M.D.

Quality in Endoscopy: Colonoscopy, Berlin 2012
### Should we use the scales?

**After washing**

<table>
<thead>
<tr>
<th>Quality</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Good</td>
<td>clear fluid only or opaque fluid easily suctioned</td>
</tr>
<tr>
<td>Adequate</td>
<td>opaque fluid and some adherent stool can be washed away to provide reasonable views for exclusion</td>
</tr>
<tr>
<td>Poor</td>
<td>Solid or adherent stool : impossible to wash away. No exclusion value</td>
</tr>
</tbody>
</table>
Bowel preparation (general principles)

- clear instructions/phone line
- anticipate likely poor prep (co-morbid, hospitalised, constipated, previously failed)
- At least 24hrs dietary restriction
- use barrier cream!
- enema on arrival in unit if prep. Fails
- split preparation

Flemming J, et al. GIE 2012
Bowel preparation

Fluid management

◆ rotate scope to keep fluid at 5 o’clock position
Use a washing pump
Mechanical cleansing: rescue therapy
“ClearPath” & “JetPrep”
Bowel preparation
Fluid management

◆ use air to displace solid matter not water
◆ use anti-bubble agent
◆ listen carefully!
Polypectomy in poor bowel preparation

- exchange gas several times
- use CO$_2$
- use cold snare techniques

DON’T DO IT!!!!

Ladas et al. World J Gastroenterol 2007
Ideal modern bowel preparation

- rapid and complete purge
- pleasant tasting and easy to complete
- safe with no side effects
- cheap
Traditional Methods

• Stimulant laxatives (senna, bisacodyl)
• Enemas (tap water or phosphate)
• Mannitol (10% 1-2 litres)
• High volume lavage 7-12 litres of saline!
• Caster oil
• Magnesium citrate purge ± stimulant laxative
  
  (Picolax, Picoprep, CitraFleet, Citramag)

  2 LITRES + CLEAR FLUIDS
PEG-electrolyte (Golytely)

◆ formulated by Davis & Fordtran in 1980

◆ Non-absorbed macrogol polymer + balanced electrolyte solution (osmotically balanced)

◆ 4 litres effective and safe

*DiPalma et al. Am J Gastroenterol 1989*

BUT....

◆ salty taste
◆ large volume
◆ nausea and vomiting 10%
PEG-electrolyte (Golytely)

Improving palatability/acceptability

◆ chilling
◆ flavouring
◆ sulfate – free
◆ prokinetic agents
◆ simethicone
◆ split administration

El Sayed AM et al. GIE 2003
Sodium phosphate

- Low volume hyperosmotic solution
- x 2, 45ml doses given 6-12hrs apart
- 1 litre fluid also per dose
- low dose NaP 48g (Osmoprep) in tablet form (32 tablets)
Sodium phosphate: cleansing & acceptability
meta-analysis 16 clinical trials
Tan et al. Colorectal Dis 2006

<table>
<thead>
<tr>
<th>Study</th>
<th>Reference</th>
<th>PEG n/N</th>
<th>NaP n/N</th>
<th>OR (fixed) 95% CI</th>
<th>OR (fixed) 95% CI</th>
</tr>
</thead>
<tbody>
<tr>
<td>Vanner et al</td>
<td>[17]</td>
<td>16/48</td>
<td>43/54</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Kolts et al</td>
<td>[24]</td>
<td>24/30</td>
<td>27/34</td>
<td>0.13 [0.05, 0.31]</td>
<td></td>
</tr>
<tr>
<td>Marshall et al</td>
<td>[16]</td>
<td>52/73</td>
<td>48/70</td>
<td>0.43 [0.15, 1.28]</td>
<td></td>
</tr>
<tr>
<td>Cohen et al</td>
<td>[22]</td>
<td>141/279</td>
<td>90/143</td>
<td>1.13 [0.56, 2.32]</td>
<td></td>
</tr>
<tr>
<td>Chia et al</td>
<td>[16]</td>
<td>25/40</td>
<td>33/39</td>
<td>0.60 [0.40, 0.91]</td>
<td></td>
</tr>
<tr>
<td>Golub et al</td>
<td>[20]</td>
<td>198/223</td>
<td>94/106</td>
<td>0.30 [0.10, 0.89]</td>
<td></td>
</tr>
<tr>
<td>Henderson et al</td>
<td>[15]</td>
<td>92/100</td>
<td>92/101</td>
<td>1.01 [0.49, 2.10]</td>
<td></td>
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<tr>
<td>Clarkston et al</td>
<td>[25]</td>
<td>40/49</td>
<td>40/49</td>
<td>1.31 [0.42, 3.04]</td>
<td></td>
</tr>
<tr>
<td>Thomson et al</td>
<td>[13]</td>
<td>30/55</td>
<td>39/61</td>
<td>1.00 [0.36, 2.78]</td>
<td></td>
</tr>
<tr>
<td>Lee et al</td>
<td>[12]</td>
<td>65/88</td>
<td>50/71</td>
<td>0.68 [0.32, 1.43]</td>
<td></td>
</tr>
<tr>
<td>Arezzo</td>
<td>[11]</td>
<td>50/100</td>
<td>68/100</td>
<td>1.19 [0.59, 2.38]</td>
<td></td>
</tr>
<tr>
<td>Kastenberg et al</td>
<td>[21]</td>
<td>325/432</td>
<td>361/427</td>
<td>0.47 [0.26, 0.84]</td>
<td></td>
</tr>
<tr>
<td>Ell et al</td>
<td>[10]</td>
<td>94/113</td>
<td>15/60</td>
<td>0.56 [0.39, 0.78]</td>
<td></td>
</tr>
<tr>
<td>Seinela et al</td>
<td>[9]</td>
<td>27/35</td>
<td>30/37</td>
<td>1.48 [0.91, 3.18]</td>
<td></td>
</tr>
<tr>
<td>Law et al</td>
<td>[23]</td>
<td>59/106</td>
<td>126/193</td>
<td>0.79 [0.25, 2.46]</td>
<td></td>
</tr>
<tr>
<td>Huppertz-Hauss et al</td>
<td>[26]</td>
<td>62/76</td>
<td>71/84</td>
<td>0.67 [0.41, 1.08]</td>
<td></td>
</tr>
<tr>
<td>Total (95% CI)</td>
<td></td>
<td>1855</td>
<td>1629</td>
<td>0.75 [0.65, 0.88]</td>
<td></td>
</tr>
<tr>
<td>Total events:</td>
<td></td>
<td>1300 PEG; 1227 NaP</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Sodium phosphate superior cleansing to PEG-ELS p=0.0004

<table>
<thead>
<tr>
<th></th>
<th>Na phosphate</th>
<th>PEG-ELS</th>
<th>Prob</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ability to complete</td>
<td>94%</td>
<td>71%</td>
<td>p&lt;0.00001</td>
</tr>
</tbody>
</table>

Quality in Endoscopy: Colonoscopy, Berlin 2012
Sodium Phosphate complications

- Nausea, vomiting, abdominal pains
- Mucosal abnormalities
- Electrolyte imbalance
  - hypernatraemia
  - hyponatraemia
  - hyperphoshatemia
  - hypocalcaemia
  - hypokalaemia
- Acute phosphate nephropathy (nephrocalcinosis 1-4%)
Bi-phasic increase in serum & urinary phosphorous
### Acute Phosphate Nephropathy

<table>
<thead>
<tr>
<th>Timing</th>
<th>Early symptomatic</th>
<th>Late insidious</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>&lt;24 hrs</td>
<td>days to months</td>
</tr>
<tr>
<td>Symptoms</td>
<td>lethargy, confusion, tetany, seizure</td>
<td>asymptomatic, non-specific</td>
</tr>
<tr>
<td>electrolytes</td>
<td>hyperphosphatemia &amp; hypocalcaemia</td>
<td>normal</td>
</tr>
<tr>
<td>Phosphate load</td>
<td>excessive</td>
<td>standard</td>
</tr>
<tr>
<td>Pathology</td>
<td>unknown</td>
<td>nephrocalcinosis</td>
</tr>
<tr>
<td>Treatment</td>
<td>IVI, oral phosphate binder, calcium gluconate, dialysis</td>
<td>none</td>
</tr>
<tr>
<td>Outcomes</td>
<td>recovery, death or CKD</td>
<td>CKD</td>
</tr>
</tbody>
</table>

**Note:** The table provides an overview of the timing, symptoms, electrolytes levels, phosphate load, pathology, treatment, and outcomes for Acute Phosphate Nephropathy, distinguishing between early symptomatic (within 24 hours) and late insidious (days to months) presentations.

**Quality in Endoscopy: Colonoscopy, Berlin 2012**
Acute Phosphate Nephropathy

*risk factors*

- older age (>65yrs)
- existing renal dysfunction
- chronic heart failure
- diabetes
- diuretics, ACE inhibitors and Angiotensin Receptor Blockers
Sodium phosphate

recommendations to avoid renal injury

• avoid use in high risk groups
• minimize the dose (use low dose 48g)
• increase interval between two doses
• ensure adequate fluids orally or IV
• consider checking electrolytes post colonoscopy & treat electrolyte abnormalities
Low volume
(2 litre PEG/electrolyte) +
ascorbic acid

- ascorbic acid - osmotic laxative
- lemon flavouring
Low dose PEG + ascorbic acid vs 4litre PEG

<table>
<thead>
<tr>
<th></th>
<th>Moviprep (n=153)</th>
<th>4litre PEG (n=155)</th>
<th>Prob</th>
</tr>
</thead>
<tbody>
<tr>
<td>Acceptable prep</td>
<td>88.9%</td>
<td>94.8%</td>
<td>NS</td>
</tr>
<tr>
<td>Bad taste</td>
<td>12%</td>
<td>26%</td>
<td>p&lt;0.025</td>
</tr>
<tr>
<td>Patient acceptability</td>
<td>27.6</td>
<td>34.2</td>
<td>p&lt;0.025</td>
</tr>
<tr>
<td>0-----100 VAS</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Nausea</td>
<td>14%</td>
<td>23%</td>
<td></td>
</tr>
<tr>
<td>Electrolytes</td>
<td>no change</td>
<td>no change</td>
<td></td>
</tr>
</tbody>
</table>

Ell et al. Am J Gastroenterol 2008
## Low dose PEG + ascorbic acid vs sodium phosphate

<table>
<thead>
<tr>
<th></th>
<th>Moviprep (n=169)</th>
<th>phosphosoda (n=171)</th>
<th>Prob</th>
</tr>
</thead>
<tbody>
<tr>
<td>Clinically successful prep.</td>
<td>72.5%</td>
<td>63.9%</td>
<td>NS</td>
</tr>
<tr>
<td>Patient satisfaction</td>
<td>20.4</td>
<td>23.9</td>
<td>NS</td>
</tr>
<tr>
<td>(0---100 VAS)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Adverse events</td>
<td>3%</td>
<td>11.1%</td>
<td>p=0.003</td>
</tr>
<tr>
<td>(clinical side effects or electrolyte disturbance)</td>
<td></td>
<td>(2 cases of severe hypokalaemia)</td>
<td></td>
</tr>
</tbody>
</table>

*Bitoun et al. Alimentary Pharmacology and Therapeutics 2006*
2 litres PEG + ascorbic acid ("Moviprep")

€

expensive

5-6x > Mg citrate
Mg Citrate (2 litres) is as effective as PEG & better tolerated

<table>
<thead>
<tr>
<th>Author</th>
<th>Yr</th>
<th>Comparator</th>
<th>Pt no</th>
<th>Trial type</th>
<th>Cleansing</th>
<th>Tolerability</th>
<th>Complications</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mishima</td>
<td>08</td>
<td>PEG &amp; senna vs Mg (both +/- additional prokinetic)</td>
<td>225</td>
<td>REB</td>
<td>NSD</td>
<td>NSD</td>
<td>None reported</td>
</tr>
<tr>
<td>Rapier</td>
<td>06</td>
<td>PEG vs Mg &amp; bisocodyl</td>
<td>114</td>
<td>REB</td>
<td>NSD</td>
<td>NSD</td>
<td>None reported</td>
</tr>
<tr>
<td>Regev</td>
<td>98</td>
<td>PEG vs Mg &amp; SPS</td>
<td>68</td>
<td>REB</td>
<td>Mg&gt;PEG score 1-4 mean score p=0.036</td>
<td>Mg &gt; PEG ‘discomfort’ P&lt;0.01 ‘nausea &amp; vomiting’ P&lt;0.05</td>
<td>None reported</td>
</tr>
<tr>
<td>Renault</td>
<td>07</td>
<td>PEG vs Mg &amp; SPS</td>
<td>73</td>
<td>REB</td>
<td>NSD (Mg&gt;PEG p=0.06)</td>
<td>Mg&gt;PEG ‘acceptable’ p=0.01 ‘taste’ p=0.003</td>
<td>None reported</td>
</tr>
</tbody>
</table>
Mg Citrate & NaP have similar efficacy but Mg is better tolerated

<table>
<thead>
<tr>
<th>Author</th>
<th>Yr</th>
<th>Comparator</th>
<th>Pt no</th>
<th>Trial type</th>
<th>Cleansing</th>
<th>Tolerability</th>
<th>Complications</th>
</tr>
</thead>
<tbody>
<tr>
<td>Berkelhammer</td>
<td>02</td>
<td>NaP vs Mg</td>
<td>300</td>
<td>REB</td>
<td>Mg&gt;NaP</td>
<td>NaP&gt;Mg by 77% of those who had taken both in past</td>
<td>NaP &gt; Mg rectosigmoid ulcers p&lt;0.01</td>
</tr>
<tr>
<td>Delegge</td>
<td>05</td>
<td>NaP &amp; clear diet vs Mg, bisacodyl &amp; low residue diet</td>
<td>506</td>
<td>REB</td>
<td>Mg&gt;NaP</td>
<td>Mg&gt;NaP ‘tolerable’ P&lt;0.01 ‘willing to repeat’ P&lt;0.001</td>
<td>None reported</td>
</tr>
<tr>
<td>Schmidt</td>
<td>04</td>
<td>NaP vs Mg &amp; SPS</td>
<td>400</td>
<td>REB</td>
<td>NSD</td>
<td>Mg &gt; NaP ‘tolerable’ ‘taste’ ‘nausea’ ‘abdo pain’ ‘thirst’ all p&lt;0.0005</td>
<td>None reported</td>
</tr>
<tr>
<td>Tjandra</td>
<td>06</td>
<td>NaP vs Mg &amp; SPS</td>
<td>225</td>
<td>REB</td>
<td>NaP&gt;Mg</td>
<td>NSD</td>
<td>None reported</td>
</tr>
</tbody>
</table>

Quality in Endoscopy: Colonoscopy, Berlin 2012
Bowel prep safety: British guidelines…”draft”

Kidney function (U & E + eGFR) compulsory prior to bowel preparation with NaP or Mg citrate (recommended prior to PEG)

- Diabetes
- Hypertension
- Cardiovascular disease
- Multi-system disease (lupus etc)
- Family history of kidney disease
- Haematuria/proteinuria

PEG for stage 4/5 kidney disease
Bowel prep safety: British guidelines…”draft”

- ACE inhibitors & angiotensin II receptor blockers
  - Stop on day of administration and for 3 days post-procedure
- Diuretics
  - Check kidney function - ensure hydration & use PEG preparation. Discontinue on day of procedure
- NSAID’s
  - Discontinue on day of procedure and for 3 days post-procedure
Conclusions
(bowel preparation is crucial for quality colonoscopy)

Effective cleansing

<table>
<thead>
<tr>
<th>Rating</th>
<th>Treatment</th>
</tr>
</thead>
<tbody>
<tr>
<td>+++</td>
<td>4 litres PEG-ELS</td>
</tr>
<tr>
<td>+++</td>
<td>phosphosoda</td>
</tr>
<tr>
<td>+++</td>
<td>2 litre PEG-ELS (+ bisacodyl)</td>
</tr>
<tr>
<td>+++</td>
<td>Mg citrate (+ senna)</td>
</tr>
<tr>
<td>+++</td>
<td>2 litres PEG/ascorbic acid</td>
</tr>
</tbody>
</table>

Patient acceptability & safety

+++

Quality in Endoscopy: Colonoscopy, Berlin 2012