

A randomized prospective trial comparing 45 and 90-ml oral sodium phosphate with X-Prep in the preparation of patients for colonoscopy

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Abstract

Forty-six patients were randomized to receive either 45 or 90-ml oral sodium phosphate (NaP) (Fleet Phospho-Soda), or X-Prep (a Senna preparation) before elective colonoscopy to compare the quality of colon cleansing, ease of preparation, and gastrointestinal intolerance. Before colonoscopy, one of us administered a questionnaire to the patient to assess how well the preparation was tolerated (scale from 1 to 5: 1 = easy, to 5 = unable to finish) and about the presence of four symptoms: abdominal pain, nausea, vomiting, and dizziness. The quality of colon cleansing was graded by two gastroenterologists (1 = excellent, 2 = good, 3 = fair, 4 = poor), who were unaware of how the patient was prepared or tolerated the preparation. The overall quality of bowel preparation with 90-ml oral NaP was better than with X-Prep and 45-ml NaP ($p < 0.01$). Patients found preparation with NaP to be easier than X-Prep ($p < 0.002$). No difference was seen in the incidence of abdominal pain, nausea, vomiting or dizziness. In the 90-ml NaP group, a significant rise in sodium and chloride occurred. However, increments were not greater than 5%. Hyperphosphatemia was noted with NaP, but was transient, and no concomitant decrease in calcium was seen. We conclude that, in the groups of patients studied, 90-ml NaP is a safe colonic cleansing agent that is better tolerated and more effective than others. (*Acta gastroenterol. belg.*, 1998, 61, 281-284).

Key words: colonoscopy, sodium phosphate, X-Prep.

Introduction

For years the standard method of cleansing the colon prior to barium enema (1,2), colon surgery (3) or colonoscopy (4) was a combination of dietary restrictions, purgatives and cleansing enemas. This preparation is time-consuming, the use of laxatives causes abdominal distress, and the application of an enema immediately before the examination is uncomfortable (5,6). The whole-gut irrigation first described for colon surgery by Hewitt in 1973 (7), the saline lavage for barium enema introduced by Lewy in 1976 (5), and the Golytely solution, a modification of saline lavage, described by Davis in 1980 (8) shortened the time for preparation of the colon and resulted in an excellent cleansing effect (6-11). The main problem with this kind of preparation is the need to rapidly drink a large volume of salty liquid (5). Although usually satisfactorily tolerated, some 5% to 15% of patients either have difficulty drinking the large amounts of fluid necessary or develop symptoms (e.g., nausea, vomiting, discomfort) so they are not able to complete the preparation (12-14). Moreover, Hangartner *et al.* showed that while 4 liters of Golytely and X-Prep plus enema had equivalent cleansing efficacy for colonoscopy, patients judged X-Prep to be less unpleasant (15).

In 1990, a report from Vanner *et al.* (16) was the first to describe the efficacy and safety of oral sodium phosphate (NaP), a highly osmotic cathartic, as a colonoscopy preparation. The use of oral NaP solution for colonoscopy preparation is appealing because patients need to take much less fluid than with polyethylene glycol (PEG)-electrolyte lavage (e.g., Golytely). It has been reported that oral NaP solution is better tolerated and more effective than PEG-electrolyte lavage (17,18).

The purpose of this study is to compare the efficacy (by colonoscopy) and patient acceptance of 45 and 90-ml of oral NaP solution with X-Prep in a single blinded randomized study.

Methods

Patient selection: Informed written consent was obtained from each patient participating in this study, which was approved by the hospital ethics committee. Forty-six consecutive patients, requiring an elective colonoscopy were randomly divided into three groups receiving one of three cleansing regimens: 1) X-Prep ($n = 14$); 2) NaP, 45 ml ($n = 14$) and 3) NaP, 90 ml ($n = 18$). Exclusion criteria were a creatinine ≥ 2.3 mg/dl, massive ascites, symptomatic congestive heart failure, prior colonic surgery, active inflammatory bowel disease, or an acute myocardial infarction within the past 6 months. All groups were found to be comparable for age and sex ratio. Patient age, gender and indication for elective colonoscopy are listed in table I.

Study solutions: Following enrollment in the study, a physician gave general instructions to each subject. All patients received a liquid diet the day before the procedure and remained non per os after midnight. Those randomized to X-Prep (group-1) received 250 ml of X-Prep (Sennoside A+B 0.15 g) at 7 PM the evening before the procedure. Those randomized to 45 ml of NaP (group-2) received only 45 ml of Fleet Phospho-Soda (48 g $\text{Na}(\text{PO}_4)_2 + 18$ g $\text{NaHPO}_4/100$ ml) diluted 1:1 with water (total of 90 ml; 64 mg phosphorus/ml) at 7 PM that evening. Those randomized to 90-ml of

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Table I. — Demographics on 45 patients having elective colonoscopy

Category	Group-1*	Group-2**	Group-3***
Number	14	14	18
Age	54 ± 14	54 ±	59 ± 16
Male/Female	9/5	8/6	12/6
<i>Endoscopik diagnosis (%)</i>			
— Colitis	29	14	17
— Carcinoma	7	0	11
— Diverticular disease	7	14	11
— Polyps	7	7	17
— Other	7	7	6
— Normal	50	58	38

* X-Prep ; ** 45-ml of NaP ; *** 90-ml of NaP.

NaP (group-3) received 45 ml of Fleet Phospho-Soda diluted to 90 ml with water at 7 PM the evening before the procedure and again at 6 AM the morning of the procedure. The patients were instructed to drink at least three 12-oz glasses of water 1 h after the 7 PM dose. No enemas were administered prior to colonoscopy.

Patient tolerance : Before colonoscopy, one of us (M.C.) administered a questionnaire to the patient to assess how well the preparation was tolerated and about the presence of four symptoms : abdominal pain, nausea, vomiting, and dizziness. Patients ranked the ease of completing the preparation (tolerance), by choosing one of five categories : easy, tolerable, slightly difficult, extremely difficult, and unable to finish. In addition they ranked the severity of specific symptoms of nausea, vomiting, abdominal pain, and dizziness from 0 to 3 (no symptoms = 0, mild = 1, moderate = 2, and severe = 3).

Effectiveness of cleansing agent : Colonoscopies were performed between 9:30 AM and 2 PM the next day. The Physicians' Desk Reference recommends a 3-hour period after the last dose before the procedure (19). Video-colonoscopy was applied with Olympus CF-10L colonoscope and Olympus OVC-200 video-converter. The quality of colon cleansing was graded by the two gastroenterologists (Ü.B.D. & Z.Ö.), who were unaware of how the patient was prepared or tolerated the preparation. The quality grades were excellent (small volume of liquid easily aspirated, but covering less than 5% of the colonic surface), good (volume of clear liquid covering 5-25% of the surface but could be easily aspirated to expose nearly all the mucosa), fair (some semi-solid stool limited the examination but could be suctioned or washed away to expose 90% or more of the mucosa), poor (less than 90% of the mucosa could be examined because of semi-solid stool that could not be suctioned or washed away).

Assessment of safety : After the questionnaire was completed and before receiving iv sedation, each patient was questioned about symptoms of paresthesias, palpitations, muscle spasms of the extremities, or seizures

that might suggest symptomatic hypocalcemia due to hyperphosphatemia. Blood tests of urea, creatinine, electrolytes, calcium, and phosphate were obtained on admission and the morning of the procedure.

Statistical analysis : Student's t test was used to compare blood tests, questionnaire responses and the quality of colon cleansing.

Results

Ninety-seven percent described the ease of completing the NaP solution as easy or tolerable compared with 64% for the X-Prep (59% easy, 38% tolerable for NaP, 28% and 36% for the X-Prep, respectively). The difference was significant ($p < 0.002$). No patients were unable to finish the preparation.

Assessment of symptoms of nausea, vomiting, abdominal pain, and dizziness occurring during the evacuation of the colon did not reveal any statistically significant differences between the groups.

The quality of colon cleansing for the three groups is presented in figure 1. 90-ml of oral NaP solution was better in achieving an excellent (39%) or good (44%) cleansing score compared with the 45-ml of NaP solution (14% and 29%) or with X-Prep (7% and 36%). The difference was significant in achieving an excellent but not good cleansing score ($p < 0.02$). Since a good cleansing score, i.e., volume of clear liquid covering 5-25% of the mucosal surface, should be adequate for a fastidious examination after the liquid is aspirated, it was logical to combine the good and excellent results and reevaluate significance. When this was done, 90-ml of oral NaP solution was statistically better in achieving an excellent or good cleansing score with 83% compared with 43% for the 45-ml of NaP solution and 43% for the X-Prep ($p < 0.01$).

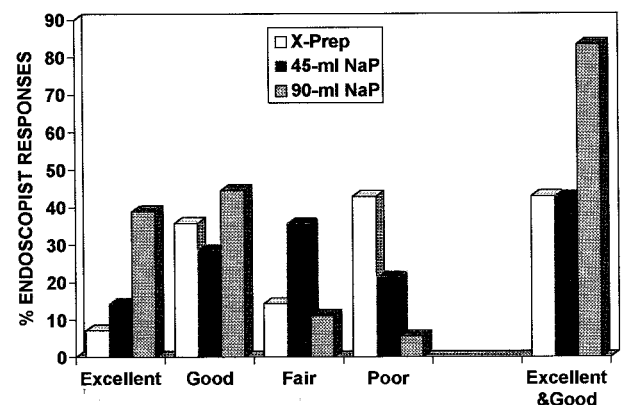


Fig. 1. — Number rating of the adequacy of colonic cleansing.

Table II shows the mean change from admission to the morning of the procedure in the serial blood tests for all groups. In the 90-ml NaP group, a significant rise in sodium ($p < 0.02$) and chloride ($p < 0.002$) occurred. However, these remained within the normal laboratory range, and deviations were no greater than

Table II. — Mean difference
in blood tests compared to baseline

Blood tests	X-Prep	45-ml NaP	90-ml NaP
Na ⁺ (mEq/L)	0.00	+ 0.07	+ 3.33*
K ⁺ (mEq/L)	- 0.16	- 0.25	- 0.09
Cl ⁻ (mEq/L)	+ 1	+ 0.86	+ 4.89**
BUN (mg/dl)	- 0.36	+ 2.71	+ 0.61
Creatinine (mg/dl)	+ 0.03	- 0.06	+ 0.06
Calcium (mg/dl)	- 0.09	- 0.07	+ 0.01
Phosphate (mg/dl)	- 0.13	+ 0.38****	+ 2.51***

+/- values represent mean increase (+) or decrease (-).

* p < 0.02; ** p < 0.002; *** p < 0.001; **** p = 0.02.

5%. Mean serum phosphate level increased significantly in group-2 (p = 0.02), and group-3 (p < 0.001). There was no significant change in the mean serum calcium concentration. None of the patients taking the oral NaP solution reported or demonstrated signs or symptoms of hypocalcemia.

Discussion

Preparation of the colon for colonoscopy must be simple, efficacious, and associated with minimal side effects for the patient. Since laxatives do not easily meet this requirement, various means of preparation are recommended, with variable efficacy and acceptance.

The rapid ingestion of large volumes of a balanced electrolyte solution which results in absorption of water and electrolytes is contraindicated in patients intolerant to such a regimen (8). The sweet lavage with Mannitol does not induce such water and sodium movement, but it does enhance the production of explosive gas mixtures (20). The Golytely solution containing polyethylene glycol 4000 as a poorly absorbed non-electrolyte was developed to eliminate significant intestinal fluxes of both water and electrolytes. Furthermore, the absence of explosive gas mixtures permits colonoscopic polypectomy (21). However, preparation by PEG-electrolyte lavage requires the patient to drink a large volume of fluid (1 gallon) of a specially formulated solution during a short period of time (2.5 to 3 hours). Despite the advantage of short preparation time, some 5% to 15% of patients have difficulty drinking the large quantity of fluid necessary for satisfactory colon preparation by this method (12-14). Moreover, Hangartner *et al.* showed that while 4 liters of Golytely and X-Prep plus enema had equivalent cleansing efficacy for colonoscopy, patients judged X-Prep to be less unpleasant (15).

To avoid the problems above, a small-volume preparation is needed. A small-volume, rapidly acting oral regimen laxative sodium phosphate in a dosage of 90-ml can also be used as preparation for colonoscopy (16). This method of preparation is appealing because patients need to take much less fluid than with PEG-electrolyte lavage.

To evaluate the efficacy and patient acceptance of different doses of NaP, we prospectively studied 45 and 90-ml oral NaP solution and X-Prep in 46 patients

referred for colonoscopy. The cathartic action of the NaP results largely from its osmotic properties, and given its small volume, yet produce large resulting effluent. Concerns about potential intravascular volume depletion have been described (22). Evidence of a slight increase in intravascular volume depletion in the 90-ml NaP group was demonstrated by the serial biochemical measurements (table II). However, the minimal perturbation in these values suggest that, it was of a minor degree. Clinically significant changes in intravascular volume were not seen. Hyperphosphatemia was observed with NaP preparation, but no concomitant decrease in serum calcium was seen.

Whereas this study demonstrated NaP to be a safe agent, these findings may not apply to those patients with symptomatic heart failure, ascites, or creatinine of ≥ 2.3 mg/dl (exclusion criteria for this study), as they may be susceptible to even minimum changes in intravascular volume. Consequently, caution should be exercised in using this preparation in these patients. In addition, because NaP causes some degree of hypovolemia, we believe it is prudent to insure that patients maintain adequate fluid intake during the course of their preparation, although this was not done in the present study.

The qualitative assessment of colonoscopy by the endoscopist was equally good for group-1 (X-Prep) and group-2 (45-ml NaP). 90-ml NaP had the best cleansing efficacy, the difference to the X-Prep and 45-ml NaP was significant (figure 1). The acceptance of the regimen was significantly better in NaP groups (group-2 and 3) than in group-1 patients. Side effects of cleansing methods were comparable in all groups.

We conclude that 90-ml NaP is a safe colonic cleansing agent that is better tolerated and more effective than others. It would be recommended as the agent of choice for most patients.

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