

Efficiency and safety of oral sodium phosphate in colon cleansing

Oral sodyum fosfatın kolon temizliğinde etkinliği ve güvenilirliği

Hakan BOZKAYA MD¹, Halil ÖZTÜRK MD², Yusuf UZUN MD¹, Ali ÖZDEN MD¹

Ankara Üniversitesi Tıp Fak. Gastroenteroloji¹ ve İç Hastalıkları² Bilim Dalları, Ankara

ÖZET: Bu çalışmada elektif kolonoskopi gereken hastalarda oral sodyum fosfatın (NaP) etkinliği ve güvenilirliği sınılandı. Çalışmaya 20 hasta dahil edildi. Su ile 1:1 dilüe kırkbeş mL Fleet Fosfo-Soda, kolonoskopi öncesi gün saat 16.00 ve kolonoskopi sabahı saat 6.00'da toplam iki kez olmak üzere verildi. Hazırlık boyunca ve sonrasında elektrolit değişikliklerini monitörize etmek için kan örnekleri toplandı. Hastaların ilacı kabulü ve NaP in etkinliği değerlendirildi. Tüm hastalar hazırlıklarını tamamladılar. Hastaların %80'i hazırlık rejimini kolay veya tolere edilebilir olarak buldu. Hastaların yarısı semptomsuzdu ve yalnızca bir hastada ciddi bulantı ve kusma vardı. Kolonoskopist tüm hastalarda kolonoskopi işlemini tamamladı. Olguların %95'inde kolon mükemmel veya iyi temizlenmiş olarak değerlendirildi. Hazırlık boyunca ve sonrasında serum klor ve sodyum düzeylerinde değişiklik kaydedilmedi. NaP verilmesinden sonra hafif ama belirgin hiperfosfatemi ve hipokalsemi saptandı. Serum potasyum düzeylerinde daha ciddi bir düşme gözlemlendi. Elektrolit değişiklikleri son serum örneklerinde normale dönme eğiliminde idi. Sonuç olarak, NaP hastalar tarafından yüksek oranda kabul edilen efektif bir kolon temizleme ajanıdır. Hipopotasemik etkisi klinik zeminde diğer elektrolit değişikliklerinden daha önemli olabilir.

Anahtar Kelimeler: **Oral sodyum fosfat, kolon temizliği**

SUMMARY: In this study, efficiency and safety profile of oral sodium phosphate (NaP) were tested in patients requiring elective colonoscopy. Twenty patients were included in the study. Forty-five mL of Fleet Phospho-Soda diluted 1:1 with water was given twice at 4.00 p.m the day before the colonoscopy and 6.00 a.m. the morning of colonoscopy. To monitorize the electrolyte changes blood samples were collected during and after preparation. Patients' acceptance and efficiency of NaP were assessed. All the patients finished their preparations. 80% of patients found the preparation as easy or tolerable. Half of the patients were symptom-free and only one patient had severe nausea and vomiting. Colonoscopist completed the procedure in all cases. 95% of colons were ranked as excellent or good by means of cleaning. No change was recorded in mean serum chloride and sodium levels during and after preparation. Slight but significant hyperphosphatemia and hypocalcemia were detected after NaP administration. More severe drop was seen in serum potassium level. Changes in electrolytes tended to normalize in the latest serum samples. In conclusion, NaP has a high patients' acceptance and is an effective agent for colon cleansing. Its hypopotassemic effect may be more important than the other electrolyte abnormalities at the clinical settings.

Key Words: **Oral sodium phosphate, colon cleansing**

RAPID methods using large volume solutions for colon cleansing have become more popular in past few years (1-3). Osmotically balanced large volume polyethylene glycol and large volume saline solutions have been shown to be more effective compared to standard 2-day preparations (4,5). However large volume of electrolyte lavage can reduce patients' compliance, thus inability to complete the preparation can result in a poorly cleansed colon. Recent studies suggested that oral sodium phosphate (NaP), a small volume osmotic cathartic, may be superior to the large volume osmo-

tically balanced polyethylene glycol solution for colon cleansing prior to colonoscopy (6). Despite the recent findings, it is not yet widely used because there is a need for further studies to document the efficacy of NaP solution in colon cleansing. Although previous studies suggested that NaP is safe, this small volume cathartic may produce a significant intravascular volume contraction and hyperphosphatemia that could result in hypocalcemia (7,8). Thus, safety profile of NaP for colon cleansing also needs to be determined.

In this study we aimed to test the patients' compliance and efficacy of small volume oral NaP preparation and to document the safety profile of

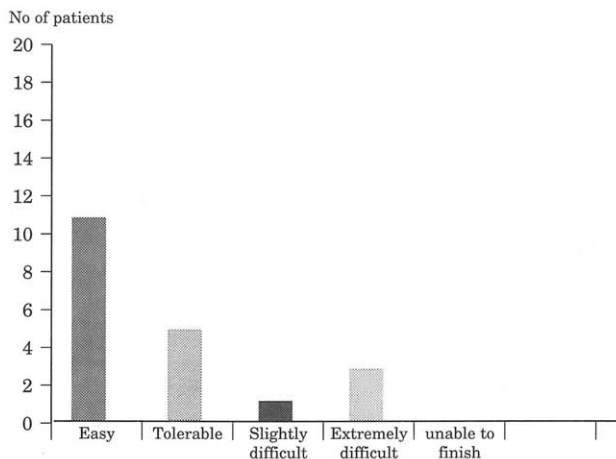


Figure 1. Patients acceptance for NaP preparation

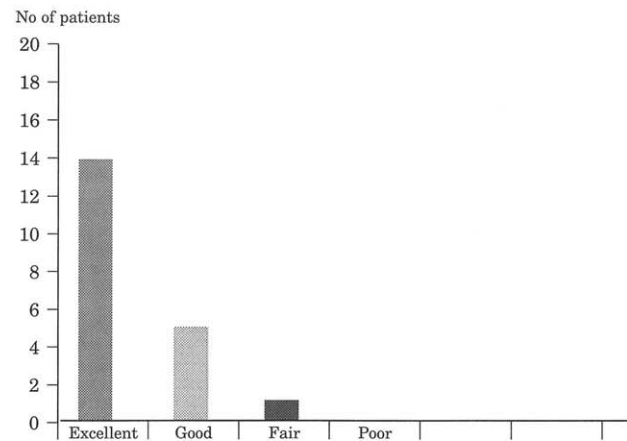


Figure 2. Effectiveness of NaP in colon cleansing

NaP by monitoring the electrolyte changes during the patients' preparation for colonoscopy.

PATIENTS AND METHODS

Patients: Twenty patients, 11 male 9 female, age between 15-69 (mean 43.5) years, requiring an elective colonoscopy were included in the study. Exclusion criteria were acute diverticulitis, active inflammatory bowel disease, unstable cardiovascular or respiratory status, myocardial infarction or cerebrovascular accident in the last 6 months, massive ascites, serum creatinine greater than 1.5 mg/dl and diuretic use. Indications for colonoscopy were as follows: change in bowel habits 9(45%), weight loss 2 (10%), Crohn disease 4 (20%), control polypectomy 1 (0.5%), amebiasis 1(0.5%), liver metastasis 1(0.5%), Behçet's disease 2(10%).

Preparation and sample collection: Patients received a liquid diet the day before the procedure. Patients were instructed to drink two doses of 45 mL of Fleet Phospho-Soda (Fleet Pharmaceuticals; containing 21.6 g monobasic sodium phosphate and 8.1 g dibasic sodium phosphate diluted 1:1 with water total 90 mL) at 4.00 p.m. the day before the colonoscopy and at 6.00 a.m. the morning

of the procedure. At least three 200 mL glasses of water 1 hr after both doses were given to the patients. Colonoscopies were performed between 2.00 p.m and 4.00 p.m.

To monitorize the electrolyte changes (Sodium, Potassium, Chloride, Calcium, Phosphate) blood samples were collected before the preparation (4.00 p.m.), 2hr after the second dose of NaP in the morning of colonoscopy (8.00 a.m) and at 4.00 p.m. following colonoscopy.

Patients' acceptance: After completion of preparation prior to colonoscopy, each patient was asked to choose one of the five categories: easy, tolerable, slightly difficult, extremely difficult and unable to finish.

Patients also ranked the severity of specific symptoms of nausea, vomiting, abdominal pain, chest pain and dizziness from 0 to 3: no symptom= 0, mild= 1, moderate= 2, severe= 3.

Table 1. Symptoms due to the sodium phosphate preparation.

	No symptom	Mild	Moderate	Severe
Nausea	10 (50%)	3(15%)	6(30%)	1(5%)
Vomiting	10 (50%)	3 (15%)	6(30%)	1(5%)
Abdominal pain	13(65%)	4(20%)	3(15%)	0
Chest pain	18(90%)	1(5%)	1(5%)	0
Dizziness	12(60%)	3(15%)	3(15%)	2(10%)

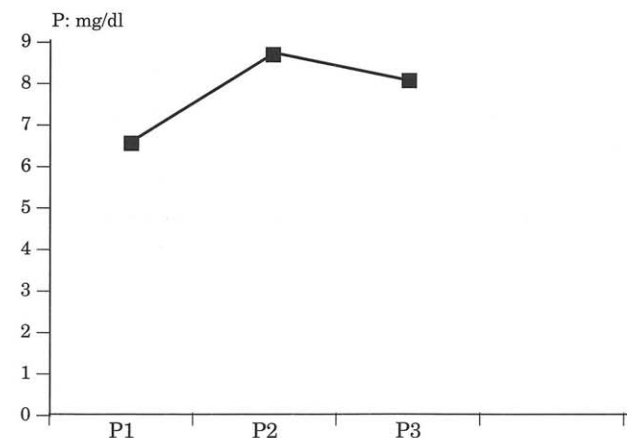


Figure 3. Change in serum phosphate level during and after preparation. P1: First day 4 p.m. P2: second day 8 a.m. P3: Second day 4 p.m.

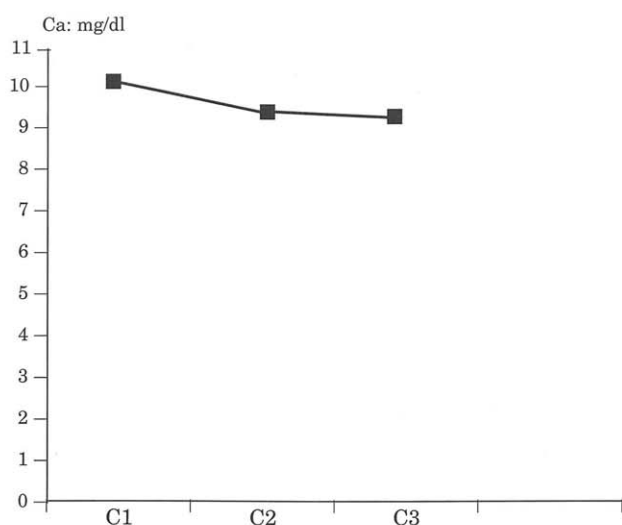


Figure 4. Change in serum Ca level during and after preparation

C1: First day 4 p.m. C2: Second day 8 a.m. C3: Second day 4 p.m.

Assessment of colon cleansing: Effectiveness of NaP in colon cleansing was assessed for the presence of liquid or stool:

- 1- Excellent: small volume of clear liquid
- 2- Good: large volume clear liquid
- 3- Fair: some semi-solid stool that can be suctioned
- 4- Poor: semi-solid stool

RESULTS

Patients' acceptance: None of the patients was unable to finish preparation. More than half of the patient (11/20) found the preparation as easy. Sixteen out of 20 (80%) patients ranked the acceptability of preparation as easy or tolerable (Figure 1).

During the preparation half of the patients were symptom-free (Table 1). Most frequent symptoms were nausea and vomiting (50% and 50%, respectively) and especially seen after the first dose of NaP, but only one patient had severe nausea and vomiting.

Effectiveness of NaP: Colonoscopist was able to complete the procedure in all cases. In 19 out of 20 (95%) patients, colons were ranked as excellent or good. Fourteen patients (75%) were in category "excellent" (Figure 2). While none of the colon felt the category "poor", only one patient had "fairly" cleaned colon.

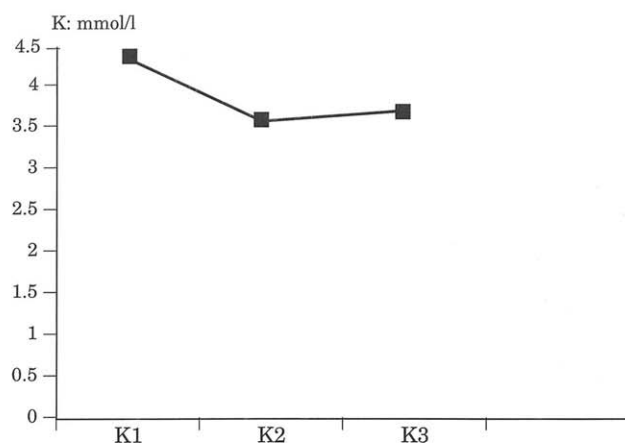


Figure 5. Change in serum K level during and after preparation

Electrolyte changes: While changes in mean serum phosphate, calcium and potassium were statistically significant, there was no change in mean serum chloride and sodium levels. Three patients did not show any increase in serum phosphate levels, remaining 17 (85%) had elevated phosphate levels following administration of NaP.

Calcium levels decreased in all but 5 patients, however reduced levels were not below the lower limit of normal range. Among 5 patients without any decrease in calcium levels, 3 did not have an increase in serum phosphate levels.

Except two, all the patients had a decrease in serum potassium levels. Serum potassium levels were below the lower limit in almost half of the patients (45%) studied.

Elevated phosphate levels were inclined to decrease (Figure 3) while reduced calcium and potassium levels tended to increase (Figure 4 and 5, respectively) in the latest serum samples (evening of colonoscopy: 4PM).

DISCUSSION

In this study we found high rates of patients' tolerance and acceptance for oral NaP preparation prior to colonoscopy. Only 3 patients (15%) found the preparation difficult to complete and all the patients were able to finish their preparations. Enhanced acceptance and tolerance of NaP are probably related to small volume of this preparation. Large volume preparations are difficult to tolerate for many patients and significant number of patients can not complete these preparations. It also seems that lack of severe symptoms increases

the patients' tolerance and acceptance since almost half of the patients were symptom-free and severe symptoms were detected in only 10% of patients studied.

Previous reports suggested that oral NaP is not only better tolerated, it is also more effective than the polyethylene glycol electrolyte lavage solution or castor oil (4,7). Although we did not compare the efficiencies of different preparation regimes, NaP preparation resulted in excellent colon cleansing. Ninety-five percent of colons were ranked as good or excellent cleaning.

NaP is an osmotic agent and produces a large volume effluent reducing intravascular volume. Vanner et al. reported that small number of patients developed systemic hemodynamic changes measured by means of postural change in systolic blood pressure and pulse rate (5). Intravascular volume depletion may potentially deteriorate the systemic and renal hemodynamics in patients with renal failure, congestive heart failure, ascites or dehydration. However none of our patients had such clinical conditions. On the other hand, there is no convincing data on safety of NaP preparation in this group of patients. Therefore it remains to be determined the hemodynamic effects of NaP in patients with body fluid volume disturbances.

It is known that NaP causes transient hyperphosphatemia (9,10). In our study most patients showed significant hyperphosphatemia after the second dose of NaP prior to colonoscopy. As much as earlier (evening of colonoscopy) phosphate levels tended to be decreased. Unfortunately we did not measure the serum phosphate levels in the day after colonoscopy to show a complete normalization of phosphate levels. However, elevated phosphate levels have been shown to be in normal range within 24-36 h after the latest dose of NaP (6-8). Hyperphosphatemia has a potential risk of

hypocalcemia (11,12). Although data on hypocalcemic effect of NaP are conflicting, we found a slight but statistically significant decrease in serum calcium levels. However none of our patients showed any evidence of clinically manifested hypocalcemia. Additionally serum calcium levels did not diminish below the normal range in any patients studied suggesting that NaP does not cause a clinically important hypocalcemia.

An important finding we found is that there was a significant decrease in serum potassium levels. Potassium levels decreased in 90% of patients and half of the patients had diminished levels below the lower limit of normal range. One study also reported a decrease in potassium levels in response to NaP but authors did not draw any conclusion on clinical significance of hypopotassemia (6). We have not observed any complication due to hypopotassemia. However, all our patients were uncomplicated, so it should be kept in mind that NaP may cause a clinically important hypopotassemia in patients with prior electrolyte disturbances. Either loss of potassium by stool or shift of potassium through the intracellular space, or combination of both factors may be responsible for hypopotassemic effect of NaP, but exact mechanism and clinical significance of this adverse effect need to be determined.

In summary, we found that NaP has a high rate of patients' acceptance and is an effective agent for colon cleansing. Its potential hypocalcemic effect may frequently occur but does not result in a clinically important side effect. Hypopotassemia caused by NaP may be more important than other electrolyte changes at the clinical settings. Although NaP is safe in patients without prior fluid volume and electrolyte abnormalities, further studies need to be performed to document whether it's safe or not in patients with disturbed volume homeostasis.

REFERENCES

1. David GR, Santa Ana Ca, Morawski SG, et al. Development of a lavage solution associated with minimal water and electrolyte absorption or secretion. *Gastroenterology* 1980; 78: 991-995.
2. Adler M, Quenon M, Even-Adin D et al. Whole gut lavage for colonoscopy: A comparison between two solutions. *Gastrointest Endosc* 1984; 30: 65-67.
3. Özden A, Şalvarlı Ş, Akyar S, et al. Laval PEG dengeli elektrolit solusyonu ile kolon temizliği. *Gastroenteroloji* 1994; 4: 736-739.
4. Thomas G, Brozinsky S, Isenberg JI. Patient acceptance and effectiveness of a balanced lavage solution (Golytely) versus the standard preparation for colonoscopy. *Gastroenterology* 1982; 82: 435-437.
5. Di Palma JA, Brady CE III, Stewart DL, et al. Comparison of colon cleansing methods in preparation for colonoscopy. *Gastroenterology* 1984; 86: 856-860.
6. Vanner SJ, MacDonald PH, Paterson WG, et al. A randomized prospective trial comparing oral sodium phosphate with standard polyethylene glycol-based lavage solution in the preparation of patient for colonoscopy. *Am J Gastroen-*

- terol 1990; 85: 422-427.
7. Kolts BE, Lyles We, Achem SR, et al. A comparison of the effectiveness and patient tolerance of oral sodium phosphate, castor oil and standard electrolyte lavage for colonoscopy or sigmoidoscopy preparation. *Am J Gastroenterol* 1993; 88: 12118-1223.
 8. Huynh T, Vanner S and Paterson W. Safety profile of 5-h oral sodium phosphate regimen for colonoscopy cleansing: lack of clinically significant hypocalcemia and hypovolemia. *Am J Gastroenterol* 1995; 90: 104-107.
 9. Korzets A, Dicker D, Chaimoff C, et al. Life-Threatening hyperphosphatemia and hypocalcemic tetany following the use of fleet enemas. *J Am Geriatr Soc* 1992; 40: 620-621.
 10. Davis RF, Eichner JM, Bleyer WA, et al. Hypocalcemia, hyperphosphatemia, and dehydration following a single hypertonic phosphate enema. *J Pediatr* 1977; 90: 484-485.
 11. Mc Connell TR. Fatal hypocalcemia from phosphate absorption from laxative preparation. *JAMA* 1971; 216: 147-148.
 12. Forman J, Baluarte HJ, Gruskin AB. Hypocalcemia after hypertonic phosphate enemas. *J Pediatr* 1979; 94: 140-151.