



Comparison of the Efficacy of Polyethylene Glycol, Sennoside and Sodium Phosphate in Bowel Preparation Before Colonoscopy

Kolonoskopi Öncesi Barsak Hazırlığında Polietilen Glikol, Sennozid ve Sodyum Fosfatın Etkinliğinin Karşılaştırılması

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ABSTRACT

Aim: The great majority of colorectal cancers arise from pre-existing adenomatous polyps. High-quality bowel cleansing is essential to improve the quality of colonoscopy. The most important factors in choosing a bowel cleansing agent are efficacy, tolerance, and safety. We aimed to compare the efficacy of polyethylene glycol (PEG), sennoside, and sodium phosphate for bowel cleansing in equally sized groups of patients undergoing colonoscopy at our center.

Method: A total of 600 patients undergoing colonoscopy at the University of Health Sciences Haydarpaşa Numune Training and Research Hospital General Surgery Endoscopy Unit were included in the study irrespective of age, gender, and other factors. The patients were divided into 3 equal groups and were given either 4 liters of PEG solution, 500 mL of sennoside, or 90 mL of sodium phosphate solution for bowel preparation. The adequacy of bowel preparation was assessed using the Boston Bowel Preparation Scale and the results were compared.

Results: The polyp detection rate was higher in the PEG group than in the sennoside group, and lower in the sodium phosphate group compared to both the PEG and sennoside groups. Bowel preparation scores were similar in the PEG and sennoside groups but lower in the sodium phosphate group compared to the other two groups.

Conclusion: There was no difference in the quality of bowel preparation in patients who used PEG solution and sennosides; however, we observed a difference in polyp detection rates between these groups. This difference may be attributable to other factors that affect polyp detection (cecal intubation status, withdrawal time, technical difficulties, endoscopist experience). The lower polyp detection rate among patients using sodium phosphate seems to be a result of these factors combined with inadequate bowel cleansing. Socio-demographic features of the study population also affect colonoscopy outcomes.

Keywords: Cathartics, colon, colonoscopy, colorectal, polyp

ÖZ

Amaç: Kolorektal kanserlerin büyük çoğunluğu önceden var olan adenomatöz poliplerden köken alır. Kolonoskopinin kalitesini arttırmak için yüksek kaliteli barsak temizliği şarttır. Barsak temizliği sırasında kullanılacak ajanın seçiminde en önemli faktörler etkinlik, tolerans ve güvenlidir. Biz bu çalışma ile, merkezimizde kolonoskopi yapılmış olan eşit sayıda 3 farklı gruba ayırdığımız hastada polietilen glikol (PEG), sennozid ve sodyum fosfatın barsak temizliğindeki etkinliğini karşılaştırmayı amaçladık.

Yöntem: Sağlık Bilimleri Üniversitesi Haydarpaşa Numune Eğitim ve Araştırma Hastanesi Genel Cerrahi Endoskopi Ünitesinde kolonoskopi yapılan 600 hasta, yaş, cinsiyet ve diğer faktörler dikkate alınmaksızın çalışmaya dahil edildi. Bu hastaların barsak hazırlığı, 3 eşit grup halinde 4 litre PEG solüsyonu ile, 2 adet 250 mL sennozid içeren solüsyonla ve 2 adet 45 mL sodyum fosfat içeren solüsyonla yapıldı. Barsak hazırlığının yeterli düzeyde olup olmadığı Boston Barsak Hazırlığı Ölçeği'ne göre değerlendirildi ve sonuçlar karşılaştırıldı.

Bulgular: PEG solüsyonu ile barsak hazırlığı yapılmış olan hasta grubunda polip saptanma oranı, sennozid içeren solüsyon ile barsak hazırlığı yapılan gruba göre daha yüksek bulundu. Sodyum fosfat içeren solüsyonla barsak temizliği yapılan hastalarda polip saptanma oranı, PEG ve sennozid içeren solüsyonla barsak temizliği yapılan hastalara göre daha düşük bulundu. PEG solüsyonu ile barsak hazırlığı yapılan hastalarda barsak temizliği skoru, sennozid içeren solüsyonla barsak hazırlığı yapılan hastalarla benzer özellik göstermekte iken, sodyum fosfat ile barsak hazırlığı yapılan hastalarda bu iki gruba göre daha düşük bulundu.



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ÖZ

Sonuç: PEG solüsyonu ve sennozidlerle barsak hazırlığı yapılmış olan hastalarda barsak temizliğinin kalitesi açısından fark olmamasına karşın polip saptanma oranları arasındaki fark, polip saptanma oranları üzerinde etkili başka faktörlerin de (çekal entübasyon durumu, kolonoskopik çıkış süresinin 6 dakika veya daha uzun olması, teknik sınırlamalar, endoskopistin deneyimi) olmasına bağlıdır. Sodyum fosfat tuzları ile barsak hazırlığı yapılmış olan hastalarda bu diğer faktörlere ek olarak yetersiz barsak temizliği de eklenince polip saptanma oranlarının düştüğünü görüyoruz. Çalışılan popülasyonun sosyo-demografik durumu da kolonoskopinin sonuçlarına etki eder.

Anahtar Kelimeler: Katartikler, kolon, kolonoskopi, kolorektal, polip

Introduction

The majority of colorectal cancers originate from previously existing adenomatous polyps.¹ The adenoma-carcinoma sequence offers an opportunity to protect against colorectal cancers.^{1,2} However, 3-6% of colorectal cancers are diagnosed between screening colonoscopy and follow-up colonoscopies.^{3,4} These interval cancers are believed to originate from lesions that are overlooked during screening colonoscopy.^{5,6} High-quality bowel cleansing is essential to improve colonoscopy quality, because even a small amount of fecal residue can obscure an important colorectal lesion.

The three main characteristics of a good colonoscopy are an experienced endoscopist, a cooperative patient, and a clean bowel.⁷ The principle factors in selecting a bowel cleansing agent are effectiveness, tolerability, and safety.⁸ Solutions containing polyethylene glycol (PEG) are high-volume and osmotically balanced, whereas solutions containing sodium phosphate are low-volume and hyperosmotic.^{9,10} PEG is a nonabsorbable and non-metabolic laxative that acts by drawing water into the intestinal lumen.¹¹ It may not be well tolerated because of its unpleasant taste and odor and the need to drink a large quantity in a short time.^{8,12} It is generally available in oral preparations containing sodium chloride and potassium chloride to avoid electrolyte imbalance. Sodium phosphate stimulates bowel motility, increases fluid secretion into the bowel lumen, and causes mucosal secretion of cholecystokinin. Due to its high salt content, it is contraindicated in congestive cardiac failure and hypertension.¹¹ Stimulating laxatives and purgatives affect epithelial transport of water and electrolytes and increase intestinal motility. They are cheaper, safer, and oral intake is better tolerated. Sennoside is in this group.¹³ Ample water should be consumed after taking this medicine. Its use is limited in diabetic patients due to its high sugar content. Inadequate bowel cleansing has been reported in 20% of patients scheduled for colonoscopy.^{14,15} In some publications, this figure is up to 33%.¹⁶ Inadequate bowel cleansing also leads to a high rate of repeat colonoscopy, increased complication rates, and longer procedure times.^{17,18} Inadequate colon preparation can result in prolonged cecal intubation and withdrawal times as well as reduced detection rates for both small and large polyps.¹⁹ Although guidelines

advise repeat colonoscopy in cases of suboptimal bowel preparation, in clinical practice it is often recommended to shorten the interval between control colonoscopies if there are no suspicious findings during the procedure.^{3,20,21} The aim of this study was to compare the bowel cleansing effectiveness of PEG, sennoside, and sodium phosphate in patients who underwent colonoscopy in our center.

Materials and Methods

The study included 600 patients who underwent colonoscopy by 5 experienced general surgeon colonoscopists in the University of Health Sciences Haydarpaşa Numune Training and Research Hospital General Surgery Endoscopy Unit between January 1, 2017 and March 31, 2017. All patients were included regardless of age, gender, or comorbidities. Ethical approval was obtained from the Chief of Medicine of Sağlık Bilimleri University of Health Sciences Haydarpaşa Numune Training and Research Hospital (dated 05.03.2018, protocol no: 62977267-000-3936). Repeat colonoscopies of patients with inadequate colon cleansing were not included in the study.

Bowel preparation was done using 4 liters of PEG solution in 200 patients, 2 units of 250 mL sennoside solution in another 200 patients, and 2 units of 45 mL sodium phosphate solution in the other 200 patients. In addition to the oral solutions, patients in all groups also had 210 mL rectal enemas applied twice, once the night before and the other on the morning of the procedure. All patients were instructed to stop eating solid food and to follow a clear-liquid diet for the 24 hours before the procedure.

Adequacy of bowel preparation was assessed using the Boston Bowel Preparation Scale (BBPS)²² and the results were compared between the groups (Figure 1).

In the BBPS, the three colon segments (left, transverse, right) are scored based on the level of cleanliness:

0 points: presence of solid stool prevents evaluation of colon mucosa

1 point: fecal liquid and semisolid feces are observed in the colon segment

2 points: small amount of fecal liquid but allows good evaluation of mucosa

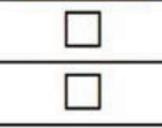
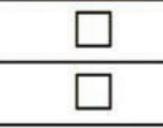
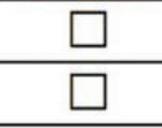
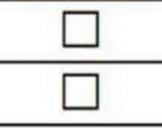
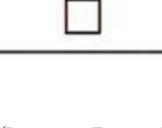
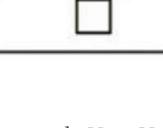
BBPS		3	2	1	0
3=Excellent 2=Good 1=Poor 0=Inadequate					
					
					
					
LC	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
TC	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
RC	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
BBPS=		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Figure 1. Boston Bowel Preparation Scale (Lorenzo-Zúñiga V, Moreno-de-Vega V, Boix J. Rev. Esp Enferm Dig. 2012; 104: 426-431.)
 BBPS: Boston Bowel Preparation Scale, LC: Left colon, TC: Transverse colon, RC: Right colon

3 points: no residue, excellent evaluation of mucosa is possible

According to the BBPS, 0 points represents inadequate bowel cleansing and 9 points reflects excellent cleansing, with higher scores corresponding to better bowel cleanliness.

Statistical Analysis

Statistical assessment was done using one-way analysis of variance and Tukey’s post-hoc test. A p value lower than 0.05 was considered statistically significant.

Results

Colon polyps were detected in 72 (36%) of the 200 patients in the PEG group. The mean bowel cleansing score in this group was 5.84 according to the BBPS. BBPS score was 5 or higher in 88% of this patient group. In the sennoside group, polyps were detected in 42 (21%) of the 200 patients. Their mean BBPS score was 5.88, with 94.75% of the patients having scores of 5 or higher. Finally, polyps were detected in 34 (17%) of the 200 patients in the sodium phosphate group. In this group, mean BBPS score was 4.8, with 71.4% of the patients having scores of 5 or higher.

The polyp detection rate among patients who used PEG solution for bowel preparation (36%) was significantly higher than that of the group who used sennoside solution (21%) (p<0.05). However, the mean bowel cleansing score was 5.84 for patients in the PEG group, compared to 5.88 in the sennoside group. Therefore, bowel cleansing score was not associated with polyp detection rate in these groups (p>0.05). Patients who used sodium phosphate solution for bowel cleansing had lower values for both polyp detection rate (17%) and mean bowel cleansing score (4.8)

compared to the PEG and sennoside groups. This indicates a significant correlation between bowel cleansing score and polyp detection rate (p<0.05).

We observed no differences between the PEG and sennoside solutions with regard to patient compliance and tolerance, whereas there was severe intolerance (nausea and vomiting due to unpleasant taste and odor) among patients who used sodium phosphate solution.

Discussion

Previous studies on the relationship between bowel preparation and polyp detection rate have yielded variable results. In one study, polyp detection rate was found to be significantly higher in patients with good bowel preparation compared to patients with excellent bowel preparation.²³ Another study showed no significant difference between good and excellent bowel preparation with regard to polyp detection rate.²⁴ In some other studies, there were no significant differences in polyp detection rate between patients with inadequate bowel preparation and those with good and excellent bowel preparation.^{25,26} In some studies, a significantly higher rate of overlooked polyps was reported in patients with inadequate bowel cleansing compared to those with good or excellent bowel cleansing.²⁷ However, yet another study demonstrated similar polyp detection rates in patients with excellent (24.2%), good (26.8%), and inadequate (22.1%) bowel cleansing.²⁸

The literature includes some publications reporting the effectiveness and superiority of PEG solution compared to sennosides^{29,30}, while others have shown it to be equally^{31,32} or less effective.^{33,34} Radaelli et al.³³ compared the

effectiveness of sennosides and standard PEG solution and demonstrated that sennosides provide higher quality bowel cleansing (90.6% vs 79.7%) and that sennoside was more easily tolerated with greater patient compliance. A study by Shavakhi et al.³² showed similarity between the effectiveness of sennosides and standard PEG solution with regard to the quality of bowel preparation, patient compliance, and tolerance. In their study, bowel cleansing quality was assessed using the Aronchick scoring scale. In the present study, the rate of polyp identification was higher among patients who used PEG solution for bowel preparation compared to those who used a sennoside solution. However, both groups had the same level of bowel cleansing quality. We used the BBPS to evaluate the quality of bowel cleansing in this study.

Quality assurance programs have been described worldwide to reduce the rate of overlooked colorectal polyps. Besides adequate colon cleansing, polyp detection rate is also affected by factors such as cecal intubation status, colonoscopic withdrawal time being 6 minutes or longer, technical limitations, and the endoscopist's experience.³⁵ In our study, patients for whom cecal intubation was impossible or posed technical difficulties were excluded from the study. All colonoscopists were careful to have a withdrawal time of 6 minutes or longer. All of the endoscopists had at least 3 years of experience. Factors such as tendency for chronic constipation, opioid addiction, taking drugs such as tricyclic antidepressants, low socio-economic level, obesity (especially large abdominal girth), and male gender are indicators of ineffective colonoscopy.^{16,34}

Our study had several limitations. Although factors such as age, gender, and comorbidities are factors that may directly affect pre-colonoscopy bowel preparation, such effects were minimized by taking these factors into consideration when choosing the bowel preparation agents to be given. For example, diabetic patients were never given a sennoside-containing solution for bowel preparation, nor were sodium phosphate salts given to patients with cardiac failure or hypertension. Because commercially available PEG solutions contain balanced electrolytes, older patients and those with comorbidities were generally given PEG solution for bowel preparation. Furthermore, as bowel cleansing is known to have a direct and definite relation with polyp detection rate, we focused on this issue rather than colonoscopy indication. Patients for whom pancolonoscopy was possible in spite of poor bowel preparation were included in the study while the repeat colonoscopies of these patients were not, because the study was primarily aimed at evaluating the cleansing ability of the bowel cleansing agents. Patients for whom

pancolonoscopy was impossible due to fecal residue were excluded from the study.

The most important indicators of adequate bowel preparation are the type of cleansing agent, adequate water consumption before the procedure, the cleansing protocol, and sufficient time between initiating bowel cleansing and the colonoscopy procedure.^{16,36} The results of our study revealed no difference in the quality of bowel cleansing between PEG solution and sennosides, but generally poor-quality bowel cleansing in patients who used sodium phosphate. This may be explained by the patients' low tolerance for sodium phosphate.

Our findings of different polyp detection rates between the PEG and sennoside groups despite comparable bowel cleansing quality may be attributed to the fact that although we attempted to minimize the impact of other factors affecting polyp detection (cecal intubation, colonoscopic withdrawal time of 6 minutes or longer, technical limitations, endoscopist experience), we could not modify patient-related factors (e.g., constipation, low socio-economic level, obesity). When these factors were combined with inadequate bowel cleansing in patients who had bowel preparation using sodium phosphate, a reduction was observed in polyp detection rate.

The socio-demographic characteristics of the study population influence the results of even a well-designed colonoscopy. These demographic variables should be further investigated in future studies.

Ethics

Ethics Committee Approval: Ethical approval was obtained from the Chief of Medicine University of Health Sciences Haydarpaşa Numune Training and Research Hospital (dated 05.03.2018, protocol no: 62977267-000-3936).

Informed Consent: Informed consent was taken from the patient.

Peer-review: External and internal peer-reviewed.

Authorship Contributions

Surgical and Medical Practices: E.G., H.A., Concept: E.G., Design: E.G., Data Collection or Processing: E.G., H.A., Analysis or Interpretation: E.G., H.A., Literature Search: E.G., H.A., Writing: E.G.

Conflict of Interest: No conflict of interest was declared by the authors.

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