The effectiveness of simethicone in improving visibility during colonoscopy when given with a sodium phosphate solution: a double-blind randomized study

Robert H. Sudduth, MD, Sofia DeAngelis, RN, Kenneth E. Sherman MD, PhD, Peter R. McNally, DO

Aurora, Colorado

Background: **Oral sodium phosphate solution is better tolerated than polyethylene glycol when used for colonoscopy preparation, but visibility of the lumen can be impaired because of the presence of bubbles.**

Methods: **We studied 86 patients receiving either simethicone (n = 42) or placebo (n = 44) in addition to oral sodium phosphate to determine if simethicone improved visibility during colonoscopy. Patients were randomized to receive 160 mg of simethicone or a placebo with 45 ml of sodium phosphate the evening before and the morning of colonoscopy. Colonoscopy was performed by a single blinded investigator. Five areas of the colon (rectosigmoid, descending, transverse, ascending, and cecum) were assessed for the presence of bubbles on withdrawal of the endoscope. Bubbles were scored as follows: 0, minimal or none; 1, covering half the lumen; 2, covering the entire circumference; 3, filling the entire lumen.**

Results: **Thirteen patients in the placebo group and only one in the simethicone had significant bubbles ($\geq$1). Additionally, the mean bubble scores were greater in the placebo group in each region of the colon ($p \leq 0.05$ in rectosigmoid and ascending colon).**

Conclusions: **This study indicates that taking simethicone with an oral sodium phosphate preparation can improve colonic visibility by diminishing the presence of bubbles. Better visualization could improve detection of mucosal pathologic lesions. (Gastrointest Endosc 1995;42:413-5.)**

The use of oral sodium phosphate (Fleet Phospho-Soda, Fleet Pharmaceuticals, Lynchburg, Va.) has been shown to be safe, effective, and better tolerated than polyethylene glycol lavage when used for colonoscopy preparation.[1-3] At our institution, however, we have noted the presence of foam that obscures a complete luminal view in a significant percentage of examinations. A simethicone solution is frequently given through the irrigation channel to remedy the problem. Previous studies with polyethylene glycol have shown that this foaming can be prevented by administering simethicone orally along with the preparation.[4-6] Inasmuch as the co-administration of simethicone is a safe, simple, and inexpensive way to potentially improve the sodium phosphate bowel preparation, we examined its utility in a clinical setting by use of a randomized, double-blind, placebo-controlled study design.

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From the Gastroenterology Service, Department of Medicine, Fitzsimons Army Medical Center, Aurora, Colorado.

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Reprint requests: Major Robert H. Sudduth, MD, Gastro SVC Bldg 403-W, Fitzsimons Army Med Center, Aurora, CO 80045-5001.

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METHODS

Patients

One-hundred one consecutive patients were randomly assigned to undergo colon preparation with oral sodium phosphate solution combined with either simethicone or placebo.

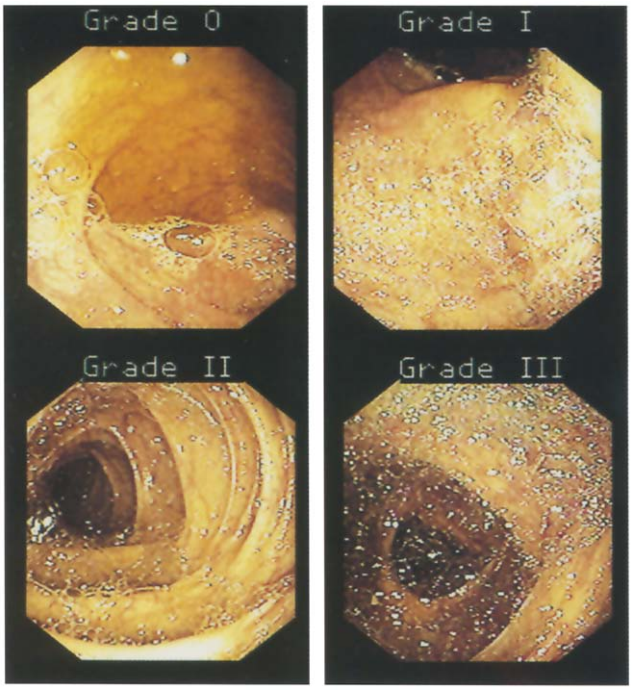

Figure 1. Grading scheme for colonic bubbles.

All adults undergoing colonoscopy, outpatient or inpatient, were eligible for the study. Patients were excluded if they had renal insufficiency (serum creatinine ≥2.3 mg/dl), symptomatic congestive heart failure, massive ascites, acute myocardial infarction within the last 6 months, or previous colonic surgery. Female candidates who were pregnant were excluded to eliminate the variable introduced by altered gastrointestinal transit time. Pregnancy testing (urine HCG) was performed where the possibility of undiagnosed pregnancy existed. Those less than 18 years old or not giving informed consent were also excluded.

Colon preparation

Patients were given a liquid diet the day before colonoscopy, and a liberal intake of water was encouraged throughout the preparation, consistent with the practice in our clinic. Each patient received 45 ml of sodium phosphate (Fleet Pharmaceuticals) diluted 1:1 with water at 4 PM the evening before the procedure, followed immediately by 2.4 ml of simethicone (160 mg) or an identical-appearing placebo in half a glass of water (placebo consisted of an equal volume of dilute cherry coloring made to appear similar in appearance to the active drug). This was repeated on arrival at the clinic at 7:30 the next morning. Further intake of water was encouraged, and the procedure was then carried out between 10 and 11 AM. The preparations were dispensed by the pharmacy.

Colonoscopy and grading scheme

Colonoscopy was performed in the usual fashion by a single investigator, accompanied by conscious sedation with midazolam and meperidine as needed for adequate sedation. The investigator was blinded to the patient's treatment. During removal of the colonoscope, five regions of the colon—rectosigmoid, descending, transverse, ascending, and cecum—were specifically examined for the presence of bubbles. Grading of each region was as follows: 0, no or minimal, scattered bubbles believed not to be interfering with the examination; 1, bubbles covering at least half the luminal diameter; 2, bubbles covering the circumference of the lumen; 3, bubbles filling the entire lumen (Fig. 1). A particular grade was assigned when more than 50% of the segment in question was involved with bubbles of this grade. Any score greater than zero was believed significant because this degree of bubbles could potentially impair visualization of the mucosa.

After grading, the use of open-label simethicone given through the irrigation channel was permitted if the examiner believed the bubbles needed to be cleared from the lumen to adequately see the mucosa. Care was taken to aspirate the simethicone back through the endoscope to prevent interference with bubble formation in subsequent areas of the colon. This solution was prepared by adding approximately 1 ml of simethicone (~67 mg) to a 60 ml syringe of water.

Table 1.
Comparison of simethicone and placebo groups*

Patient characteristics	Simethicone (n = 42)	Placebo (n = 44)
Average age (y)	62	62
Male	33	28
Female	9	16
Reason for colonoscopy		
Polyps	26	24
IBD	2	4
Bleeding	4	7
Other	10	9

*No statistically significant differences between groups.

Statistical evaluation

All data were entered into a computer-based statistical evaluation software package (STATISTIX, V4.0; Analytical Software, St. Paul, Minn.). Continuous variables were evaluated by ANOVA and the Student's *t* statistic. Discrete variables were analyzed by either chi-squared with a Yates correction for continuity or the Fisher's exact test. A two-tailed hypothesis was tested in all cases.

RESULTS

Of the 101 patients randomized, 15 were excluded from the final data analysis (9 in the simethicone group, 6 in the placebo group). Two patients in the simethicone group had incomplete examinations, one from an obstructing colon cancer, and one from a tortuous colon. Of the remaining 13 patients, 7 in the simethicone group and 6 in the placebo group could not keep their scheduled appointment.

Of the remaining 86 patients included in the data analysis, 42 received sodium phosphate plus simethicone, while 44 received sodium phosphate plus placebo. Statistical evaluation failed to reveal a difference in any demographic characteristic between the simethicone and placebo groups (Table 1).

Thirteen patients in the placebo group had significant (grade 1 or greater) bubbles in at least one segment of the colon compared with only one patient in

Table 2.
Comparison of mean bubble scores in colonic regions

	Rectosigmoid	Descending	Transverse	Ascending	Cecum
Placebo	0.34 (± 0.81)	0.27 (± 0.76)	0.27 (± 0.73)	0.2 (± 0.51)	0.11 (± 0.44)
Simethicone	0.02 (± 0.15)	0.07 (± 0.46)	0.05 (± 0.31)	0 (± 0.0)	0 (± 0.0)
p Value	0.014	0.143	0.067	0.011	0.100

the simethicone group ($p < 0.001$). Mean bubble scores for each segment of colon were compared across groups. Patients in the simethicone group had significantly lower mean scores ($p < 0.05$) in the rectosigmoid and ascending colon (Table 2).

The single highest score for bubbles found in a given patient was compared between the two groups (Table 3). Severe bubbles (score 2 or 3 vs 0 or 1) were significantly more likely to occur in the placebo group than in the simethicone group ($p < 0.05$).

The examiner believed it necessary to give open-label simethicone through the endoscope in 10 of the 13 patients (77%) with bubbles who were later found to be randomized to the placebo arm. No patients in the simethicone group required additional simethicone. In the patients getting simethicone in this fashion, a total of 218 ml was given (mean, 22 ml). This was more volume than the 201.6 ml of simethicone used as part of the preparation in the simethicone group, but because the open-label simethicone was diluted, the simethicone group received more total simethicone (13,500 mg vs 243 mg).

The average time to completion of the colonoscopy was statistically similar in both groups (28.7 minutes for simethicone, 28.5 minutes for placebo). Both preparations were tolerated well in all patients. The formulary cost of simethicone was 8 cents per ml, making a total of 38 cents per patient in the simethicone group.

Table 3.
Frequency of highest bubble score

Highest bubble score	Simethicone (n = 42)	Placebo (n = 44)
0	41	29
1	0	4
2	0	5
3	1	4

DISCUSSION

In this study one third of patients in the placebo group had foaming of sufficient severity that mucosal visualization was impaired. Furthermore, most patients that had foam had a score greater than or equal to 2 (70%). This problem was essentially eliminated in the group given simethicone along with their preparation.

Importantly, the examiner had to take the time to administer simethicone through the endoscope in most of the cases that did have foam. Although this, together with the nuisance of the foam obscuring the lumen, could potentially prolong the procedure time, this was not found. More total simethicone was used in the simethicone group, but the cost of this per patient was insignificant (38 cents).

That simethicone given orally with the colon preparation can decrease the incidence of foam is consistent with other studies using polyethylene glycol.[4-6] The formation of bubbles in the colon may relate to the concentration of mucous or biliary secretions in colonic fluid, the transit rate of fluid within the gastrointestinal tract, and the amount of air insufflated during colonoscopy. It has been our impression that the foaming is more of a problem with sodium phosphate than with polyethylene glycol, perhaps because of the smaller volume of the lavage solution. Thus, as studies have now shown the sodium phosphate solution to be better tolerated by patients,[1-3] it is helpful to know that simethicone can enhance the quality of this preparation.

In conclusion, the use of oral sodium phosphate for colonoscopy preparation can be associated with a significant amount of foaming. Simethicone given along with the sodium phosphate virtually eliminates this problem and is a safe, simple, and inexpensive intervention that can potentially enhance the detection of pathologic lesions in the colon.

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