INTRODUCTION

Colonoscopy is currently the gold standard for the investigation of the mucosa of the colon, rectum and terminal ileum, according to randomized multicenter clinical trials related to the detection of colorectal diseases. About 55% of Americans aged 50-65 years had colonoscopy and over 65 the number of exams rose to 64%. These data correspond to about three times more than the 2000 index. As a corollary, the incidence of bowel cancer has dropped by 30% in the last ten years in the United States, according to the American Cancer Society report. In Brazil, the population submitted to colonoscopy will grow, even though inadequate preparation is still a major problem.

Aim: To analyze the quality of a new intestinal preparation technique, Aquanet EC-2000, compared to oral Mannitol solution. Methods: This prospective longitudinal study enrolled 200 patients with indication for colonoscopy. The sample was randomly allocated to two groups of 100: one group received Aquanet EC-2000 to prepare for colonoscopy and the other Mannitol solution. The Boston scale was used to analyze the results. Results: As expected both preparations produced similar results with the bowel cleansing of the different regions of the colon being classified as Boston scale 3 (excellent) in most patients (p<0.05). Conclusion: The results of bowel preparation using Aquanet EC-2000 were similar to using Mannitol solution.

ABSTRACT - Background: Fifty-five percent of Americans aged 50-65 are submitted to colonoscopy. For over 65-year, this number increases to 64%. In Brazil, it is forecast that the population submitted to colonoscopy will grow, even though inadequate preparation is still a major problem. Aim: To analyze the quality of a new intestinal preparation technique, Aquanet EC-2000, compared to oral Mannitol solution. Methods: This prospective longitudinal study enrolled 200 patients with indication for colonoscopy. The sample was randomly allocated to two groups of 100: one group received Aquanet EC-2000 to prepare for colonoscopy and the other Mannitol solution. The Boston scale was used to analyze the results. Results: As expected both preparations produced similar results with the bowel cleansing of the different regions of the colon being classified as Boston scale 3 (excellent) in most patients (p<0.05). Conclusion: The results of bowel preparation using Aquanet EC-2000 were similar to using Mannitol solution.
and gravity system for mechanical removal of fecal contents. The literature has shown that other equipment such as Jetprep (Jetprep Ltd, Herzliya, Israel), Medjet, and ColoNoScopPrepTM improve bowel cleansing, are safe, effective and well tolerated by patients.  

Manitol is inexpensive, easy to administer, rapid effect, relative adhesion of the patient and with few side effects, and is as efficient as the other products in use. This result was confirmed by Nahas et al. in 1,234 colonoscopies with only 15 patients (1.2%) of this group with inadequate cleaning, interfering at the end of the examination. 

Despite the good attributes as a laxative, the opportunity for the use of Mannitol in the surgical preparation of the large intestine had a relatively short life, since it was considered to cause an increase in infection of the operative wound, a fact often attributed to the increase in the number of Escherichia coli. In addition, the most important reason for the prohibition of Mannitol was the form of its use in the preparation of the large intestine for the endoscopic examinations that favored the production of combustible gases, due to its fermentation by colonic bacteria. 

As a consequence, comparing the quality of the large intestine gas mixture in patients prepared with Mannitol and in patients prepared with castor oil, it was observed that 60% of the patients prepared with Mannitol had intestinal amounts of hydrogen and potentially explosive methane. 

The objective of the present clinical trial was to analyze and compare the intestinal preparation quality score scale between the AQ device and oral solution of Mannitol (M).

**METHODS**

**Study design**

It is a prospective longitudinal study by means of the selection of 200 patients with indication for colonoscopy, forming two groups of 100. One received the treatment with AQ and the other group M. The first one received dietary guidance and the second one orientation to laxative administration. The study was approved by the Research Ethics Committee of Hospital Beneficência Portuguesa under number 6/53.036 on May 19, 2014.

**Mannitol method**

All 100 participants were instructed to ingest 1 l of 10% Mannitol (500 ml of 20% Mannitol and 500 ml of orange juice) 12 h prior to examination. It was also requested liquid diet the day before.

**Aquanet EC-2000® Method**

All 100 participants were submitted to retrograde preparation only using AQ for intestinal lavage 1 h prior to examination. The previous day was requested a liquid diet. Patients were placed in left lateral decubitus or dorsal decubitus with flexed limbs and introduced a rectal cannula. It was connected to the AQ through a plastic hose. Only water at 36°C triply filtered with carbon passing, microsediments and ultraviolet light was used. Water infusion was first performed using gravity and then was autocorrelated (interdependence) between the studied groups. The interference of variables in the primary outcome was analyzed by means of linear regression for continuous variables. For all the tests was adopted alpha level of 0.05. Primary outcome was the percentage of patients classified as “successful” (excellent) according to the Boston Scale, and secondary outcome was the analysis of the influence of continuous or categorical predictors on the quality of bowel preparation.

**RESULTS**

Participants’ characteristics regarding age, gender, intestinal habit, constipation and diarrhea are listed in Table 1. Both M and AQ preparations were statistically significant at p>0.05 between each segment of the colon. In addition, the maximum score of 3 for each segment according to the Boston Scale was the most frequent for both methods (Table 2). In relation to group M, the mean values were 2.42 in the right colon, 2.23 in the transverse and 2.10 in the left, giving 6.75 to the final score. Regarding AQ, the mean values were 2.34 in the right colon, 1.64 in the transverse and 2.10 in the left, with a final score of 6.10 (Table 2).

**TABLE 1 - Characteristics of participants in relation to preparation Aquanet and Mannitol**

| Participant data and type of intestinal preparation | Aquanet (AQ) | Mannitol (M) | p |
|-----------------------------------------------------|--------------|--------------|---|
| Age (years)                                         | 58 (±17)     | 53 (±16)     | <0.05 |
| Gender                                              |              |              |     |
| 94% female                                          | 95% female   |              | <0.05 |
| Intestinal habit                                    |              |              |     |
| 90% normal                                          | 60% normal   |              | <0.05 |
| Constipation                                        | 8%           | 35%          | >0.05 |
| Diarrhea                                            | 2%           | 5%           | <0.05 |

Statistical analysis applied to different regions of the colon, for both procedures, the proportions observed agreed with the expected (3-excellent). Therefore, the data may be considered non-additive (no bias), i.e., intestinal preparation results using AQ were similar to the results of Mannitol (Figure 1). Furthermore, the regression and residue tests showed that there was autocorrelation (interdependence) between the...
continuous predictor (age) and the predictors response (quality of the preparation) for the AQ group, with p < 0.05, showing that the predictor age influenced the result (Figure 2). The same was not observed in group M. Already the continuous predictor “gender” did not interfere in the predictor response (quality of the preparation, Figure 2).

**DISCUSSION**

The present study showed that the AQ process was as effective as Mannitol, based on the Boston Scale score. This device was also shown to be superior to or equal to all the intestinal cleansing procedures found in the literature, both with the use of laxatives (with or without dose separation) and with other cleaning devices\(^1\). Most patients felt more comfortable for intestinal cleansing.

**TABLE 2** - Frequency, score and non-parametric correlation values of each segment of the colon, with \(p > 0.05\)

| BOSTON SCALE SCORE | Rectum - M | Frequency | Rectum score | AQ | Frequency | score |
|---------------------|------------|-----------|--------------|----|-----------|-------|
| 0                   | n=100      | 3 (3.0%)  | 2.60         | 1  | (1.0%)    | 2.57  |
| 1                   |            | 7 (7.0%)  |              | 14 | (14.0%)   |       |
| 2                   |            | 17 (17.0%)|              | 12 | (12.0%)   |       |
| 3                   |            | 73 (73.0%)|              | 73 | (73.0 %)  |       |
| Sigmoid - M         | n=100      | 7 (7.0%)  | 2.33         | 14 | (14.0%)   | 2.27  |
| 0                   |            | 12 (12.0%)|              | 24 | (24.0%)   |       |
| 1                   |            | 22 (22.0%)|              | 13 | (13.0%)   |       |
| 3                   |            | 59 (59.0%)|              | 59 | (59.0%)   |       |
| Descending - M      | n=100      | 5 (5.0%)  | 2.37         | 3  | (3.0%)    | 2.18  |
| 0                   |            | 13 (13.0%)|              | 30 | (30.0%)   |       |
| 1                   |            | 22 (22.0%)|              | 13 | (13.0%)   |       |
| 3                   |            | 60 (60.0%)|              | 54 | (54.0%)   |       |
| MÉDIUM SCORE – LEFT SEGMENT | Transverse - M | Frequency | Transverse score | AQ | Frequency | Final score |
| 0                   | n=100      | 8 (8.0%)  | 2.23         | 7  | (7.0%)    | 2.1   |
| 1                   |            | 14 (14.0%)|              | 29 | (29.0%)   |       |
| 2                   |            | 25 (25.0%)|              | 13 | (13.0%)   |       |
| 3                   |            | 53 (53.0%)|              | 51 | (51.0%)   |       |
| MÉDIUM SCORE – TRANSVERSE SEGMENT | Ascending - M | Frequency | Ascending score | AQ | Frequency | Final score |
| 0                   | n=100      | 13 (13.0%)| 2.11         | 16 | (16.0%)   | 1.74  |
| 1                   |            | 14 (14.0%)|              | 33 | (33.0%)   |       |
| 2                   |            | 22 (22.0%)|              | 12 | (12.0%)   |       |
| 3                   |            | 51 (51.0%)|              | 39 | (39.0%)   |       |
| Cecum - M           | n=100      | 17 (17.0%)| 1.91         | 29 | (29.0%)   | 1.29  |
| 0                   |            | 15 (15.0%)|              | 36 | (36.0%)   |       |
| 1                   |            | 28 (28.0%)|              | 12 | (12.0%)   |       |
| 3                   |            | 40 (40.0%)|              | 23 | (23.0%)   |       |
| Îleum - M           | n=100      | 13 (13.0%)| 2.26         | 17 | (17.0%)   | 1.90  |
| 0                   |            | 6 (6.0%)   |              | 24 | (24.0%)   |       |
| 1                   |            | 23 (23.0%)|              | 11 | (11.0%)   |       |
| 2                   |            | 58 (58.0%)|              | 46 | (46.0%)   |       |
| MÉDIUM SCORE – RIGHT SEGMENT | Final score |               |             |    |           |       |
| 0                   |            | 6.75       |               |    | >0.05     |       |
| p                   |            |            |               |    | >0.05     |       |

**FIGURE 2** - Regression of “age” in “quality of preparation”

**FIGURE 1** - Aquanet EC-2000® (AQ) vs. Manitol (M)
with AQ, without the adverse effects that occur with laxatives. The unpleasant taste and ingested volume of Mannitol was also taken into account. Also, the new equipment made possible an improvement in the preparation quality. This differentiates it substantially from other procedures found throughout the world. However, AQ has some drawbacks such as cost of deployment and undesirable symptoms. Another difference found between the two methods was obtaining a more comprehensive diagnostic framework for colonoscopy through AQ.

Routine use of colonoscopy for the screening and prevention of colorectal cancer is considered one of the most successful public health projects worldwide. Easy acceptance is due to three main factors: first, the technical suitability and evolution of the devices and the safety of the exam; second, to the practical development of the examiner’s skills; third, to the magnificence of the image revealing broad access to the fine features of the mucosa, with comprehensive criteria for diagnosis. Thus, AQ has become the most sensitive part of colonoscopy, which is why the present study is under discussion, that is, in search of a fast, efficient, cheap and safe method of preparation. The new equipment made possible an improvement in the preparation quality. This differentiates it substantially from other procedures found throughout the world. However, AQ has some drawbacks such as cost of deployment and undesirable symptoms. Another difference found between the two methods was obtaining a more comprehensive diagnostic framework for colonoscopy through AQ.

In another study with Mannitol, as a comparative example of colorectal cleansing during colonoscopy. Endoscopy; 44: 703-706.

In a recent study with Mannitol, as a comparative example of the present study, patients were randomly divided into four groups. Group A consumed clear liquid diet after lunch the day before the colonoscopy, followed by overnight fasting. Group B, however, received 250 ml of 20% Mannitol and 1 l of 0.9% saline orally at 5 h on the day of the procedure. Group C, the same regimen was done at 20 h the previous day and at 5 h on the day of the examination, and in group D, in addition to group C, 20 ml of simethicone was taken orally 30 min prior to the examination. As a result, preparation of the gut in group D was significantly better than for the other regimens for general bowel cleansing, and showed improvement of general cleansing of the distal small intestine when compared to 10 h of fasting overnight.

Despite the similarity of intestinal preparation with other retrograde methods, AQ is the only equipment currently available that works with pressure and gravity method. It has advantages over others because it is the only one that works with pressure and gravity system, increasing the efficiency of intestinal lavage. In addition, it is a retrograde method of preparation, and there is no need for oral ingestion of laxatives, thus avoiding intolerance to the preparation.

The Aquanet was shown to be as effective as Mannitol for colonoscopy by using three different propofol infusion methods and analysis of plasma concentration levels: a prospective comparative study. Arq Bras Cir Dig. 2016 Nov-Dec;29(4):264–268.

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