Unsedated Colonoscopy and the Water Method for Minimizing Discomfort in the Unsedated Patients

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A decade ago, failure of cecal intubation due to pain in ~20% of scheduled unsedated patients in the author’s veterans practice prompted the search for a less uncomfortable approach. Methods that minimized discomfort or enhance cecal intubation included use of pediatric, variable stiffness, computer-assisted, 3-dimensional magnetic imaging colonoscope, gastroscope, and inhalation of nitrous oxide or insufflation of carbon dioxide; use of hypnosis, music, audio distraction, or simply allowing patients to participate in medication administration. In addition, several water-related techniques (as adjuncts to air insufflation) enhanced speed and success of intubation, reduced discomfort but did not appear to alter the amount of medications used. Because of simplicity, the water-related techniques added to turning off of the air pump were evaluated in a series of trial-and-error modifications. The result was the development of a water infusion in lieu of air insufflation method. Subsequent refinements included suction removal of all residual air to minimize angulations at flexures. Water exchange during insertion was used to suspend and removal feces to clear the luminal view while distention of the colonic lumen was minimize. Observational studies followed by randomized controlled trials confirmed the water method (simplified nomenclature) had significant impacts on discomfort both during and after colonoscopy: reduction of medication requirement; attenuation of insertion-related discomfort, enhancement of cecal intubation, decrease of pain after colonoscopy, increase in reported willingness to repeat unsedated colonoscopy in the patients examined without sedation and reduction of recovery time burden in patients accepting the option of sedation on demand. (Intest Res 2011;9:73-84)

Key Words: Water Method; Unsedated Colonoscopy; Pain; Discomfort

INTRODUCTION

Unsedated colonoscopy is routinely available in many parts of the world including Korea1,2 where work has begun to characterize the yield of screening3,4 and surveillance5 colonoscopy. The recent acknowledgement in the Asia Pacific consensus recommendations for colorectal cancer (CRC) screening that in the multinational studies conducted by the Asia Pacific Working Group on CRC, Japanese, Korean and Chinese were found to have a higher risk of advanced neoplasia in the colon, and that colonoscopy should be recommended for CRC screening6 are the reasons for considering improved methodology for unsedated colonoscopy for CRC screening and surveillance. The recent acknowledgement in the Asia Pacific consensus recommendations for colorectal cancer (CRC) screening that in the multinational studies conducted by the Asia Pacific Working Group on CRC, Japanese, Korean and Chinese were found to have a higher risk of advanced neoplasia in the colon, and that colonoscopy should be recommended for CRC screening6 are the reasons for considering improved methodology for unsedated colonoscopy for CRC screening and surveillance. The increasing uptake of CRC screening in Korea, albeit significant only for fecal occult blood testing7 is another justification for further discussion of the subject in Intestinal Research. The in-
creasing interest in the use of deep sedation for colonoscopy even in Korea, possibly as a consequence of the recognition that unsedated colonoscopy can be uncomfortable, highlights the importance and timeliness of this review, in drawing attention to the use of the water method for colonoscopy in CRC screening and surveillance. Parts of this review were presented as a Keynote address and two separate State of the Art lectures.

**RATIONALE FOR CONSIDERING THE UNSEDATED OPTION IN COLORECTAL CANCER SCREENING**

Diagnostic and therapeutic colonoscopies were originally developed as unsedated procedures. When pain limited success of cecal intubation, sedation was introduced, e.g. in the United States (US). The practice has been extended to screening and surveillance of CRC in otherwise healthy asymptomatic individuals. In the prevention of CRC, patient time burden, sedation-related complications are recognized barriers to screening and surveillance. The need for transportation was reported by 14% of the patients as a reason for non-adherence; the need to take time off work after sedation was also an important negative incentive.

In 110 patients at one University endoscopy center in the US the time burden of screening and surveillance colonoscopy was evaluated using a detailed patient diary, all of the patients received conscious sedation. A total of 39.5 hours were spent for colonoscopy. After colonoscopy, the time to resume usual activities was 15.8 hrs and to feel back to normal was 17.6 hr; 57% reported losing ≥1 day of work.

Of 21,375 patient reports in the Clinical Outcomes Research Initiative database, 1.3% of patients sustained sedation-related complications during colonoscopy. Respiratory depression and cardiovascular complications (hypotension and bradycardia) were the commonest, and mostly self-limited. Some patients (2.9/1000) did require medications (e.g. atropine, flumazenil, and naloxone) for rescue. Five patients were hospitalized for observation (abdominal pain, prolonged sedation).

To counter the negative image of unsedated colonoscopy proponents have coined the following terms to lessen the “negative” impact: sedation-free, sedationless, and medication-free colonoscopy. To emphasize the positive consequence in the setting of CRC screening and surveillance, the term “sedation risk-free” has also been proposed. Because of its ability to obviate all sedation-related complications, unsedated colonoscopy and the capability of providing unsedated colonoscopy should be established as a “quality indicator” in CRC screening and surveillance programs. Sedation-related complications, no matter how infrequent, are “unacceptable” for an individual who is otherwise healthy and asymptomatic undergoing a screening procedure, if they can be avoided.

**OPTIONS OF COLONOSCOPY WITH AND WITHOUT ROUTINE SEDATION**

The various options of colonoscopy with and without routine sedation can be summarized as follows scheduled or unscheduled (Table 1). Unsedated colonoscopy offered to patients who consume the purge solution and arrive without an escort and do not object to having the colonoscopy done without sedation is the only unscheduled option. In community and VA practice settings 1-2% of colonoscopy patients are managed in this manner. Deep sedation, conscious sedation and unsedated colonoscopy are the scheduled options.

Since deep sedation with propofol can increase colonoscopists' productivity by at least 2/3, there is a

<table>
<thead>
<tr>
<th>Unscheduled Options of Colonoscopy with and without Routine Sedation</th>
<th>Scheduled Options of Colonoscopy with and without Routine Sedation</th>
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<tbody>
<tr>
<td>Unsedated Conscious sedation</td>
<td>Sedated As needed</td>
</tr>
<tr>
<td>Unsedated Traditional</td>
<td>Sedated On demand</td>
</tr>
<tr>
<td>Unsedated Minimal</td>
<td>Unsedated</td>
</tr>
<tr>
<td></td>
<td>Unsedated</td>
</tr>
<tr>
<td></td>
<td>Sedated</td>
</tr>
</tbody>
</table>

| Unsedated Conscious sedation                                 | Sedated As needed                                           |
| Unsedated Traditional                                         | Sedated On demand                                           |
| Unsedated Minimal                                             | Unsedated                                                   |
|                                                              | Unsedated                                                   |
|                                                              | Sedated                                                     |
Felix W. Leung: Unsedated Colonoscopy and the Water Method for Minimizing Discomfort in the Unsedated Patients

growing trend to embrace the approach in the US. Cost for the colonoscopy can increase if an anesthesiologist is involved. The scheduled, unsedated option is usually requested by the patients who are educated professionals. A majority of colonoscopy performed with traditional conscious sedation employs a combination of a narcotic pain medication which provides pain control, and a benzodiazepine which promotes amnesia. The practice of minimal sedation has also been proposed - less than the full amount administered at the outset followed by additional medications if patients experience discomfort.

Conscious sedation can also be provided as needed or on demand. The former is controlled by the colonoscopist and the latter by the patients. Both approaches start without pre-medication. Sedation as needed is assessed by the endoscopist. Only 6% required sedation when sedation as needed was described. This option therefore carries a risk of coercion as endoscopists are not as accurate as the patients in assessing colonoscopy pain. With on demand sedation patients are instructed to request additional medications if they feel they need them. This option is probably less likely to be coercive. With on demand sedation a higher proportion of patients completed without sedation when a water method (54%) was used compared with when the air method (78%) was used to aid insertion of the colonoscope. The water method also offered a significantly higher success rate (98%) than the traditional air method (78%) in scheduled unsedated patients.

In both instances of as needed or on demand sedation, completion without sedation obviates the time burden associated with recovery - both on-site and at home and all sedation-relate complications.

**VIEWS OF NON-PHYSICIANS**

Nurses who have assisted with these options view the following as benefits of not using sedation routinely. Nurse monitoring is no long mandatory. Recovery time is minimized because of the rapid turn around of the unsedated patient. Discharge planning is facilitated because the amnesic effects of sedation are obviated. Efficiency is enhanced because of less demand on manpower.

Ms Laura Johannes wrote an article in the Wall Street Journal after she herself had an unsedated colonoscopy (using the on demand sedation option). She experienced no pain and she described the patient’s perspective in her article ‘Take a Deep Breath...’ Some doctors are pushing sedation-free colon exams. Really. She later reported her readers’ experience with unsedated colonoscopy - 89% had little or no pain. The author’s veteran population provided another patients’ perspective. When the pros and cons of sedation and no sedation (Table 2) were discussed, 30% of the

<table>
<thead>
<tr>
<th>Attributes of scheduled options</th>
<th>Unsedated</th>
<th>Sedated</th>
</tr>
</thead>
<tbody>
<tr>
<td>Availability</td>
<td>Not usual, but available in the US</td>
<td>Usual in US</td>
</tr>
<tr>
<td>Risks: hypotension, hypoxia, arrhythmia, etc.</td>
<td>Almost non-existant</td>
<td>Very small</td>
</tr>
<tr>
<td>Success rate</td>
<td>80 to 90%</td>
<td>~90%</td>
</tr>
<tr>
<td>Purge preparation</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Escort</td>
<td>Not required</td>
<td>Mandatory</td>
</tr>
<tr>
<td>Drive a car after colonoscopy</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>Discomfort reduced by medication</td>
<td>Not applicable</td>
<td>Highly likely</td>
</tr>
<tr>
<td>Discomfort reduced by maneuvers employed by the colonoscopist</td>
<td>Feasible</td>
<td>Feasible</td>
</tr>
<tr>
<td>Remember discomfort</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>Remember discussion</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>Need monitoring after colonoscopy</td>
<td>No</td>
<td>Yes</td>
</tr>
<tr>
<td>Activity restriction after colonoscopy</td>
<td>No</td>
<td>Yes</td>
</tr>
<tr>
<td>May require repeat with sedation</td>
<td>If exam is incomplete and lesions are suspected</td>
<td>Not applicable</td>
</tr>
</tbody>
</table>
veterans accepted scheduled unsedated colonoscopy provided to restore access after a sedated colonoscopy program was discontinued due to inadequate nursing support and as a demonstration of patient-centered care. Sixty-eight percent of these patients viewed the absence of escort requirement as a major reason for their choice of the option - had it not been for the unsedated option, they would not have been able to participate in colonoscopy screening because they could not provide escorts. Another group of supporters of scheduled unsedated colonoscopy is the satisfied patients who may be educated professionals, Chief of Gastroenterology and Presidents of the American Society for Gastrointestinal Endoscopy. Thus, even in the US, there is definitely a place for unsedated colonoscopy. Integrated into the various scheduled and unscheduled options it minimizes patient burden in screening and surveillance colonoscopy.

**TECHNIQUES FOR MINIMIZING COLONOSCOPY DISCOMFORT**

Next, we shall discuss techniques with potential to minimize discomfort during unsedated colonoscopy. A recent review of methods to reduce discomfort during colonoscopy summarized questionnaire responses in patients who underwent unsedated colonoscopy regarding abdominal discomfort and their willingness to repeat unsedated colonoscopy. Three to 54 percent of the patients reported moderate to severe abdominal discomfort. Willingness to repeat colonoscopy without sedation ranged from 73% to 100%. Low discomfort scores were highly correlated with willingness to repeat unsedated colonoscopy in one US study. Effective approaches to reduce the dose of medication needed in the sedated patients, to minimize the level of discomfort in the unsedated patients or to enhance cecal intubation have been reported. These include use of pediatric, variable stiffness, computer-assisted, 3-dimensional magnetic imaging colonoscope or gastroscope. Other favorable approaches described in the review include use of entonox (50% nitrous oxide, 50% oxygen), carbon dioxide insufflation, hypnosis, listening to music during colonoscopy, audio distraction, patient participation in the administration of sedation medication, the options of as needed (endoscopist-controlled) or on demand sedation (patient-controlled), and extended flexible sigmoidoscopy. An update of the literature reveals further confirmation in some, but no new reports in others. Routine colonoscopy can be performed effectively with standard upper GI scopes in a western population if no colonoscope is available. When the gastroscope was used as a first line method for routine colonoscopies no statistical difference between the colonoscope and gastroscopy groups was found. Inexperienced endoscopists improved their colonoscopy performance when they used magnetic imaging endoscope, compared with the standard technique, but experienced endoscopists did not. Hypnosis continued to be reported to facilitate an adequate endoscopy intervention without any discomfort in 85% of the cases examined. Pain relief by applying transcutaneous electrical nerve stimulation (TENS) during unsedated colonoscopy was reported in a randomized double-blind placebo-controlled trial. Entonox provided better pain relief and faster recovery than midazolam-fentanyl and was more effective for colonoscopy.

**PERSPECTIVE OF THE EXPERIENCED COLONOSCOPISTS**

The practice of sedation for colonoscopy varies considerably. In the US colonoscopy is generally considered to be painful and is usually carried out with the patient under conscious sedation. After considering the high success rate of cecal intubation, endoscopists overseas and in the US have recommended that unsedated colonoscopy should be offered as an alternative to colonoscopy with sedation in selected patients. For many years, the techniques of colonoscopy used in the unsedated patients are similar to those used in the sedated patients. Unsedated patients are at risk of experiencing procedure-related discomfort which otherwise would have been attenuated with sedation. The techniques summarized above provided as adjuncts to minimize colonoscopy discomfort are worthy of consideration in the unsedated patients.

My experience indicates that scheduled unsedated colonoscopy introduced as a routine option to ensure access was acceptable to a subgroup of US veterans, but was limited by ~20% failure rate of cecal intubation due to patient discomfort. What followed were steps tak-
en to systematically develop an alternative approach to air insufflation during insertion to minimize discomfort to ensure success of cecal intubation in the scheduled unsedated patients. Water-related methods were identified as effective in facilitating insertion through segments affected by severe diverticulosis, in speeding up passage through the sigmoid colon, in decreasing colonic spasms (warm water), minimizing pain, decreasing cecal intubation time, reducing the proportion of patients who complained of abdominal pain during colonoscopy, and enhancing cecal intubation. Air insufflation even when judiciously administered lengthens as well as distends the colon, increasing the difficulty of cecal intubation in the unsedated patient. Water infusion produces local distension to facilitate passage. An early explanation of efficacy was gravity, leading the water infused into the sigmoid colon to flow into the lower-lying descending colon in left lateral position. The process thereby opens a passage through the loops and bends, and if warm water is used, the warmth in the water minimizes spasms.

DEVELOPMENT OF THE WATER METHOD

To formulate the novel warm water infusion in lieu of air insufflation method we combined the strengths of these water-related techniques described as adjuncts to air insufflation with “turning off of the air pump during insertion”, 41,43,64 Removal of residual air by suction and removal of residual feces by water exchange were subsequently incorporated. With a simplified nomenclature, the “water method” was evaluated in RCT. 39,42,65,66

OBSERVATIONAL STUDIES OF THE WATER METHOD

To initiate the evaluation process consecutive patients received full- (n=32) or half-dose (n=43) pre-medication. A water pump was used to infuse warm (37°C) water in lieu of air insufflation as the “principal modality” to minimize discomfort and aid insertion. The insertion method was studied with the air pump turned off to avoid even accidental air insufflation because insufflated air can lengthen the colon making insertion in the unsedated patient more difficult. If advancement of the colonoscope failed, the assistant would provide abdominal compression or the patient’s position would be changed. Cecal intubation was suggested in the early stage of development of the method by appropriate movement of the endoscopic image on the monitor screen when the right lower quadrant was palpated, or ~90 cm of the colonoscope in the short configuration was in the colon; and in the later stage, visualization of the appendix orifice under water. Confirmation of cecal intubation was achieved by distending the cecum with air. Cecal intubation was defined as passage of the colonoscope tip to a point proximal to the ileocecal valve so that the entire cecal caput, including the medial wall of the cecum between the ileocecal valve and appendix orifice was visible. Sufficient air was insufflated to permit examination behind folds, biopsy and polypectomy during withdrawal. 64 Equal cecal intubation rate (98% vs. 100%) and pain scores were achieved in these sedated patients. Thus, even at only one-half the usual dose of sedation medication, insertion was feasible with this warm water infusion in lieu of air insufflation method. 64

To continue the evaluation 44 consecutive veterans accepted the option of sedation on demand. They could choose the timing of the medications. Twenty-one requested medications: 4 before the start and 17 when their pain score was ≥2 (0=none, 10=most severe) during colonoscopy. Cecal intubation rate was 100% and intubation time [mean (SD)] was 14 (9) min. Twenty-three without pre-medications were able to complete unsedated colonoscopy. The cecal intubation rate was 100% and the mean intubation time was 12 (9) min. With the warm water infusion in lieu of air insufflation method combined with the option of sedation on demand 52% of these patients completed colonoscopy without sedation. 38

Further refinements included the following additions summarized in two recent reviews.  5,65 All residual air was removal by suction starting in the rectum to reduce angulations at the flexures and collapse the colon around the endoscope. The tip of the colonoscope was oriented towards the opening where the folds converge. The infused water opened the lumen if the orientation was correct. Incorrect orientation would not lead to opening of the lumen and water infusion was stopped. The tip
of the colonoscope was pulled away from the mucosa and redirected. The colonoscope was advanced by repeated “small but deliberate” insertion and withdrawal motions of the shaft of the colonoscope with a torque in the direction of the expected lumen and intermittent water infusion. Since air was not used to find the lumen, suspended residual feces obscuring the view had to be suctioned and replaced by clean water until the colonic lumen was visualized again. To avoid suctioning of the mucosa, water infusion was initiated first, followed by application of suction. The “soaking effect” of the infused water on feces adherent to the mucosa was optimized by collapse of the lumen. The simultaneous infusion and suction of water (water exchange) created turbulence to dislodge the feces from the surrounding mucosa. To clear the lumen suspended feces obscuring the view were suctioned and replaced by clean water. Most of the infused water was aspirated into the suction bottle to avoid over-distension of the colon.

The hypothesis that the method of warm water infusion in lieu of air insufflation would enhance cecal intubation and increase the proportion of patients reporting willingness to repeat scheduled unsedated colonoscopy was tested in two consecutive groups of veterans. From 6/05-5/06 air insufflation was employed (n=62). From 6/06-10/07 the method of warm water in lieu of air insufflation was used (n=63). The water group (97%) had significantly higher cecal intubation rate than the air group (76%) (P<0.05, Fisher’s exact test). The proportion reporting willingness to repeat unsedated colonoscopy was significantly higher in the water group, 90% versus 69% (P<0.05,

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Fig. 1. Outcome of randomized controlled trial in patients examined with the option of on-demand sedation. N, air=50; water=50. Pain (0=none, 10=most severe) and recovery times are median scores. Sedation medications are means. Significant difference based on Fisher’s exact test, Mann–Whitney U test and unpaired t test.
RANDEM CONTROLLED TRIALS OF AIR VERSUS WATER METHOD

A RCT of minimally sedated patients was then used to test the hypothesis that patients examined by the water method had lower pain scores and require less medication but had similar cecal intubation rate and willingness to repeat future colonoscopy. Pre-medications were administered as 0.5 increment of Fentanyl (25 μg) and 0.5 increment of Midazolam (1 mg) plus 50 mg Diphenhydramine. The air (n=28) or the water (n=28) method was implemented. At the patients’ request additional medications were administered. Compared to the air method group, in the water method group increments of medications [mean (SD)] used before reaching the cecum [1.6 (1) vs. 2.4 (1), P<0.0027], total increments used [1.8 (1) vs. 2.5 (1), P<0.014] and the maximum pain scores [1.3 (1.6) vs. 4.1 (3.2), P<0.0002] were significantly lower (P<0.05, Student’s t test). Cecal intubation rate (100%) and willingness to repeat (96%) were similar. These benefits were reproduced even in colonoscopies performed by experienced (~400 colonoscopies) supervised trainees.

In the next RCT designed to confirm the beneficial effect of the water method and document patient recovery time burden, 100 sedation on demand veterans were randomized to the air (n=50) or water (n=50) method. The proportion of patient who could complete colonoscopy without sedation in the water group (78%) and the air group (54%) were significantly different (P=0.01, Fisher’s exact test), but cecal intubation rates were similar (both 100%). The water method reduced medication requirement, Fentanyl 24.0 (30.7) vs. 12.5 (26.8) μg; Midazolam 0.94 (1.2) vs. 0.5 (1.1) mg; maximum discomfort during colonoscopy 4.9 (2.0) vs. 2.3 (1.7); recovery time on-site 12.3 (9.4) vs. 8.4 (6.8) min and at home 10.9 (14.0) vs. 4.5 (9.2) hours (P=0.045; P=0.06; P=0.001; P=0.02; P=0.005, Student’s t test, respectively). Patient recovery time burden was significantly minimized by the combination with on demand sedation.

In a prospective RCT of scheduled unsedated patients, the hypothesis that the water method has beneficial effects and significantly attenuates discomfort was tested. Veterans were randomized to undergo colonoscopy with the air (n=40) or water (n=42) method (Fig. 2). Cecal intubation, 78% vs. 98%; and willingness to repeat, 78% vs. 93%, were significantly better for the water method (P<0.05; Fisher’s exact). The median maximum discomfort during colonoscopy was 6 vs. 3, P=0.004 (Mann-Whitney U test); and median overall discomfort after colonoscopy was 3 vs. 2, P=0.052 (Mann-Whitney U test), respectively. The method but not patient characteristics was a predictor of discomfort, t=-1.998, P=0.049, R²=0.074. The odds ratio for failed cecal intubation was 2.09 (P=0.006, Fisher’s exact test).
for the air group. Fair/poor prior experience increased risk of failed cecal intubation in the air group only. The RCT data confirmed the water method significantly enhanced cecal intubation and willingness to repeat.

THE INTERNATIONAL PERSPECTIVE

The findings in a recent Korean study that drinking warm water alongside sodium phosphate significantly decreased pain at the sigmoid colon and splenic flexure during and at 2 hr after unsedated colonoscopy are consistent with the results of the water method described in this review. The hospitalization of the patients on the day before colonoscopy and the use of sodium phosphate, however, somewhat limit its applicability in the US due to concerns over cost of hospitalization and published renal side-effect of sodium phosphate. Given the nuances of the water exchange component of the water method, it is not surprising that another study in Korea failed to show a reduction of pain scores when the water-related technique was implemented by trainees using a limited volume (200 mL) of water. The findings in the two RCT are also being confirmed by several presentations at the 2011 Digestive Disease Week.
meeting. One RCT from India\textsuperscript{69} shows water infusion significantly reduced the proportion of unsedated patients with pain score $\geq 2$ (0=none, 5=most severe) compared with the air method ($P<0.05$). Another RCT from Italy\textsuperscript{70} shows warm water infusion is associated with a significant decrease in the proportion of patients requesting on-demand sedation as compared to air insufflation, an improvement in patient tolerance and decrease in colonoscopy-related pain. Another RCT from Germany\textsuperscript{71} comparing water infusion vs. air insufflation for aiding colonoscopy insertion in unsedated patients at screening colonoscopy shows that water infusion permits cecal intubation in 78% and 60% with the water and air method, respectively, a significantly higher proportion with the water ($P<0.05$).

**SUMMARY**

In summary, the above reports focused on incremental steps taken to confirm that cecal intubation could be accomplished using water in lieu of air during insertion in the fully sedated patients,\textsuperscript{64} in patients given half the usual doses of sedation medications,\textsuperscript{64} in patients given minimal sedation,\textsuperscript{36,37} in patient offered the option of sedation on demand,\textsuperscript{38,39} in sedated\textsuperscript{37,66} patients examined by supervised trainees and in patients who underwent scheduled unsedated colonoscopy.\textsuperscript{31,42} Except for one study in unsedated patients examined by supervised trainees,\textsuperscript{68} emerging data from overseas studies employing the water-related methods appear to provide additional confirmation.

**DETAILS OF THE PRACTICAL STEPS OF THE WATER METHOD**

The most current version of the water method as the sole modality for facilitating insertion\textsuperscript{65} can be summarized as follows (Fig. 3 and Table 3). Air is used only during withdrawal. To avoid elongation of the colon, the air pump is turned off during insertion. To minimize angulations of the flexures, all residual air in the colon is removed by suction. Water is infused to identify the lumen. To clear the view, water exchange is used. Unlimited water is supplied by the water pump, and most of the infused water is removed during insertion by the water exchange maneuver. Upon entering an air-filled rectum all the residual air is removed by suction. The tip of the endoscope is pushed against the point

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**Table 3. Detailed Practical Steps of the Water Method to Aid Colonoscope Insertion**

<table>
<thead>
<tr>
<th>Step</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Check the function of the air and water pump on the colonoscope and the accessory water pump used for delivery of water for water exchange.</td>
</tr>
<tr>
<td>2.</td>
<td>Turn the air pump built into the light source off.</td>
</tr>
<tr>
<td>3.</td>
<td>When air pockets are encountered remove all residual air by pointing the tip of the colonoscope into the air pocket (e.g., rectum, splenic flexure, redundant segments along the colon, hepatic flexure or cecum) and apply suction.</td>
</tr>
<tr>
<td>4.</td>
<td>Direct the tip of the colonoscope to abut the slit-like opening or where the folds converge.</td>
</tr>
<tr>
<td>5.</td>
<td>If there is no obvious opening ahead, move the tip of the colonoscope systemically in a 360 degree fashion while simultaneously infusing and suctioning water.</td>
</tr>
<tr>
<td>6.</td>
<td>Infuse only sufficient amount of water to confirm that the lumen ahead opens up to allow passage of the colonoscope, and stop water infusion if the lumen does not open, pull back, redirect the tip of the colonoscope, and repeat the process.</td>
</tr>
<tr>
<td>7.</td>
<td>Avoid suction of the mucosa by adjusting (i.e., decreasing) the level of wall suction, or by initiating water infusion just before pressing on the suction button.</td>
</tr>
<tr>
<td>8.</td>
<td>If the bowel preparation is suboptimal, be patient; remove as much of the residual feces as possible and infuse clean water for visualization of the lumen. It is easier to clean the mucosa in a water-filled collapsed colon than in an air-filled distended colon.</td>
</tr>
<tr>
<td>9.</td>
<td>Do not forget to remove the infused water by suction when the insertion is going smoothly. A distended colon even by water increases discomfort for the patient.</td>
</tr>
<tr>
<td>10.</td>
<td>Note under-water appearance of diverticular openings to avoid inappropriate infusion of water; the appendix orifice and red suction mark in the cecum to recognize cecal intubation.</td>
</tr>
<tr>
<td>11.</td>
<td>Colonoscope-shortening maneuver, abdominal compression, and patient reposition are integral components. Employ these maneuvers if necessary (e.g., lumen ahead cannot be seen, looping occurs). These may be needed less often than when the air method is used.</td>
</tr>
</tbody>
</table>
where the folds converge. Water is infused to confirm that the lumen lies ahead. The turbulence in the vicinity of the tip of the colonoscope dislodges feces from the adjacent mucosa. Water exchange is used to remove residual feces and keep the colonic lumen minimally distended. Eventually, the lumen clears. The appendix opening under water takes on an appearance of multiple concentric circular folds. Sometimes, red suction marks also indicate arrival in the cecum. Most of the dirty water should be in the suction bottle during insertion. A suboptimal bowel preparation can be salvaged by the water exchange.

CONCLUSION

Developed for and confirmed to meet the specific need to minimize discomfort and enhance cecal intubation in scheduled unsedated patients\(^1\),\(^2\) the water method successfully lowered maximum and overall pain scores during and after colonoscopy, enhanced cecal intubation and willingness to repeat scheduled unsedated colonoscopy. It appears to have additional serendipitous impact in decreasing the amount of sedation required to complete colonoscopy in the sedated patients. When the option of on demand sedation is offered to the patients, over three-quarters of the patients were able to complete colonoscopy without sedation using the water method compared with only one half using the air method. There were significant savings in on-site and at home recovery times in the water compared with the air method group. A major drawback is that the observations were made in predominantly male veteran patients. Recent overseas data appear to provide confirmatory evidence of the efficacy of the water method in lowering colonoscopy discomfort. Investigators intrigued by these results are encouraged to support the development of well-designed RCT to critically evaluate the hypothesis that adherence to the above description of the water method (particularly the execution of water exchange) will be applicable to screening colonoscopy in diverse cultural settings and geographical locations.

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