Various Materials for Luminal Distention during Colonoscopy: Air, Water, CO₂, and Others

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Introduction

Although improvements in colonoscope technology have been accomplished, several fundamental problems are remained such as cecal intubation rate/time, patient discomfort during and after colonoscopy. At least partial distention of the lumen is required to get adequate visualization to advance the colonoscope to the cecum during the insertion. During withdrawal, a larger luminal distention is needed to allow optimal examination of the colonic mucosa. Gaseous and liquid agents have been used for colonic luminal expansion such as carbon dioxide and warm water. The ideal agent would facilitate the outcomes of colonoscopy including cecal intubation, mucosal visualization, reducing intra- and postprocedure pain. Through this presentation, various opinions on luminal distention during colonoscopy would be discussed.

1. Water instillation

Water-assisted colonoscopy is one of the methods which has become increasingly popular in the last few years. So far, many RCTs on water immersion colonoscopy were carried out using no, minimal, or on-demand sedation assessing the patient’s pain either during or immediately after the procedure or both. There are two representative methods used as water-assisted colonoscopy. One is water immersion and the other is water exchange method. Water immersion is defined when the infused water stays in the colon to facilitate insertion and is removed predominantly during withdrawal, whereas water exchange is described when water infusion expanding colonic lumen and removal of dirty water are performed together during insertion phase to clear up the residual feces.¹

They reported that water-assisted colonoscopy had improved clinical outcomes for patients and endoscopist as well. A significant decrease in patient’s pain scores, enhancing cecal intubation, and significantly less sedation with the water-assisted colonoscopy were shown.²⁶ Recent systematic review concluded that water-assisted colonoscopy reduced colonoscopy associated pain and may increase adenoma detection rate.¹ Another meta-analysis showed that water-assisted colonoscopy was related to lower abdominal pain scores, and less need for sedation. For adenoma detection rate, water-assisted colonoscopy was not inferior to air insufflation in the analysis. However, most of the studies on water-assisted technique were single-center studies, and various water infusion methods in terms of water temperature, amount of water, location for infusion were used.
Furthermore, they did not show consistent results in adenoma detection rate, and cecal intubation rate and time. On the other hand, in clinical practice, these kinds of enhancing colonoscopic methods has been developed for the patients in whom difficult colonoscopy are expected, for example, old age female, lower body mass index, chronic constipation, previous abdominopelvic surgery, and so on. Basically, Potential benefits of these methods include straightening and/or opening the sigmoid colon, reducing spasm, avoiding air-induced distention and elongation of the colon, and enhancing colonoscopy insertion. But, there were few studies regarding the effectiveness or efficacy of water-assisted colonoscopy in those difficult patients, so further studies for the patients would be necessary to define the role of the method.

Not only improving patient and endoscopist satisfaction for colonoscopic procedure itself but also lesion detection ability and usefulness during therapeutic colonoscopy are also important. For adenoma detection rate, there have been controversies whether water immersion technique is favorable or not. Recently, several reports regarding the feasibility and efficacy of water immersion method during therapeutic colonoscopy, including bleeding control, and endoscopic mucosal resection. However, further studies are needed to validate the results of this study.

2. Carbon dioxide (CO$_2$)

“Room air” is typically used for insufflation during colonoscopy. Because air insufflated during colonoscopy is not well absorbed through the colon, it must either be suctioned before the end of the procedure or passed from the colon as flatus. This less absorbability of air during colonoscopy can have the potential for residual air to cause bowel distention and abdominal pain.

CO$_2$ has the property of being rapidly absorbed from the colonic lumen into the bloodstream, then eliminated from the body via respiration. This benefit is the rationale for using CO$_2$, which allows the colon to decompress more rapidly and decreases in procedural abdominal pain and discomfort. Furthermore, other outcomes, such as sedation requirements, procedure time, and recovery time could be more reduced compared to conventional room air practice.

Recently, a meta-analysis comparing air and CO$_2$ reported that a smaller proportion of patients who received CO$_2$ as the insufflating gas complained any abdominal pain compared with air. The use of CO$_2$ was associated with a relative risk of 0.26 (95% CI, 0.16-0.43) for the presence of any abdominal pain at 1 hour post-procedure. Also, the reduction in procedure-related pain was consistent. Self-reported flatus at 1 and 6 hours post-colonoscopy was also reduced in patients who received CO$_2$. However, there was no difference in cecal intubation rates, cecal intubation times, total examination times, or adverse events between air and CO$_2$ groups.

Another systematic review found that decreased pain in the CO$_2$ group in comparison with the air group. The CO$_2$ group had a higher proportion of pain-free patients for both the 1-hour and 6-hour postprocedural times, compared with the air group, but at the 24-hour after colonoscopy, the proportions of pain-free patients were more comparable between 2 groups. Studies that have included abdominal radiography 30 minutes to 6 hours after colonoscopy have demonstrated significant less intestinal gas with CO$_2$ group. For the safety, there were no adverse respiratory complications were reported during CO$_2$ insufflation. In recent study evaluating end-tidal CO$_2$ (ETCO$_2$) levels as a primary outcome, there was a slight increase in ETCO$_2$ for sedated patients compared with unsedated patients, regardless of the type of gas used for insufflation.

Other outcomes with colonoscopy including patient satisfaction, cecal intubation rate and time, and so on,
revealed that no difference between the CO2 and air groups regardless of the type of gas used for insufflation.\textsuperscript{12}

3. Other agents

Originally, various agents for luminal distention have been evaluated in laparoscopy. Helium, argon, nitrogen, and xenon have been assessed as insufflation gases for laparoscopy. However due to absorbability, and availability, their application were not allowed to colonoscopy.

Intraluminal administration of corn oil for lubrication has been reported, but there were controversy on the cecal intubation and visualization.\textsuperscript{3,13} Intraluminal 200 mL of a dilute peppermint oil solution showed an good spasmolytic effect compared to a placebo saline solution.\textsuperscript{14} However, these agents were not for colonic luminal expansion, but only for enhancing colonoscopy procedure.

Conclusions

Water-assisted colonoscopy showed the effects reducing patient’s pain and amount of sedatives and analgesics during colonoscopy. And it may also showed the potential to overcome the difficult colonoscopy cases. However, for the other outcomes including adenoma detection rate, procedure time which could be affected by various extrinsic factors, there have been inconsistent results according to the studies.

CO2 insufflation method decreases intra- and post-colonoscopy abdominal pain so that need for sedation can be decreased and patient’s satisfaction can be increased. But there was no difference for the other outcomes compared to air group as water-assisted methods did.

In sum, these various materials for luminal distention during colonoscopy have been evaluated to make patients more comfortable during or after colonoscopy. This will allow unsedated colonoscopy to be used more widely. However, these efforts would be less important in Asian countries where unsedated colonoscopy is already common. Therefore, further studies evaluating not only clinical outcomes but also cost-benefit associated with their own social and cultural situations are needed, and with the studies, the indication and application of those luminal distention methods will be determined.

References