



WATER ASSISTED COLONOSCOPY (WAC) - WATER IMMERSION AND WATER EXCHANGE

Gastroenterology

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ABSTRACT

Colonoscopy is a widely performed diagnostic and therapeutic procedure in gastroenterology. However, the patient adherence to colonoscopy is less due to pain, discomfort and need for repeat procedures for incomplete colonoscopy. Due to above reasons various adjuncts to traditional air insufflated (AI) colonoscopy have been developed including CO₂ insufflation and water assisted colonoscopy (WAC) insertion technique. Water immersion and water exchange colonoscopy are two types of WAC. WAC are less painful, have a higher rate of cecal intubations, better bowel preparation and improved ADR when compared to AI colonoscopy. WAC not only help in insertion but also have therapeutic implication e.g. UEMR, Underwater polypectomy, Derotation of Sigmoid volvulus.

KEYWORDS

Water assisted Colonoscopy (WAC); Water immersion; Water exchange.

INTRODUCTION

Colonoscopy is the most common test used worldwide for screening of colorectal cancer and diagnosis of several gastrointestinal diseases in clinical practice (1, 2). The patient acceptance and adherence rates for Air insufflated (AI) colonoscopy is poor due pain, discomfort, or unpleasant experiences faced during pre-colonoscopy preparation (1). Maintaining adequate luminal distension is key during colonoscopy for safe insertion as well as for diagnosis and therapeutic procedures. Traditionally Air is being widely used during insufflation.

Pain during AI colonoscopy insertion is commonly attributed due to distension and elongation of the colon and looping at the sigmoid. In order to improve patient's tolerance and satisfaction, most AI colonoscopy is done with analgesic or sedative agents (e.g. propofol, Ketamine, fentanyl, midazolam, etc.). However, these medications carry the risk of complications, the most fatal being respiratory and cardiovascular problems particularly in older individuals with comorbidities (3).

In order to improve patient related outcomes for colonoscopy various adjuncts have been tried instead of Air. CO₂ insufflation was proposed instead of air in 1953 and is now commonly accepted that it is superior to air in reducing pain and discomfort during colonoscopy. (4) Similarly, Water as an adjunct was suggested instead of air in 1980's in patients with diverticulosis. (5)

Air insufflation causes distension of colon as well as elongation of colon (Figure 1). It also leads to sharpening of bends and angulations, promoting loops formation during colonoscopy. The overall effects lead to uncomfortable procedure, pain and bloating and greater requirement of sedation. In contrast to above, water infusion avoids this over-distension and elongation of colon and straightens the colon avoiding loop formation leading to better tolerated procedure and reduced sedation requirement. (6)

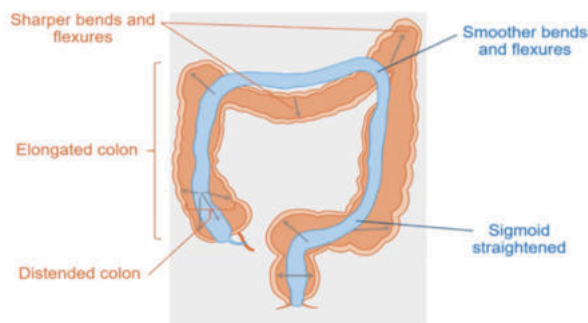


Figure 1: Air Insufflated vs. Water assisted colonoscopy
Air Insufflated Colon Water Assisted

The benefits of WAC arise from two principal mechanisms (Figure 2): First, the use of water exerts a gravitational effect and reduces colonic elongation, thereby reducing loop formation, procedure discomfort

and sedation requirements, and second water irrigation improves mucosal views and can increase adenoma detection rates (ADR). (9)

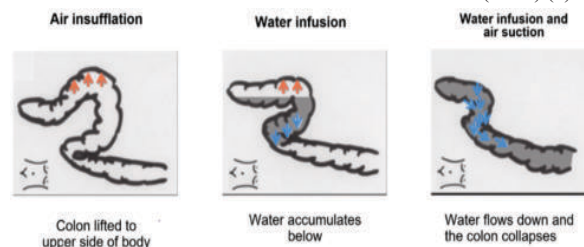


Figure 2: Rational for Water Assisted colonoscopy
Water immersion vs. Water exchange colonoscopy.

WAC is a colonoscopy procedure which uses water as an adjunct for insertion with or without air or CO₂ insufflation. WAC encompasses 2 main techniques: (9)

- 1) Water immersion
- 2) Water exchange

Water immersion:

Water (200-300ml) is infused to facilitate scope progression through sigmoid and cecal intubation as an adjunct to gas insufflation (room air or CO₂) which may be used as needed during insertion and most of the water infused is aspirated during withdrawal. It facilitates and speeds sigmoid insertion, reduces colonic spasm and reduces pain/discomfort.

Water exchange:

It is a standardized insertion technique in which water infused is removed mainly during insertion along with removing all residual air pockets to allow progression in clear water without any air insufflation during insertion. It prevents colonic elongation, reduced loop formation, less frequent position change and thus reduced pain. It also improves colonic preparation by clearing opaque water and progression in clear water leading to improved detection during withdrawal phase.

Table 1: Water immersion and Water exchange colonoscopy

	Insertion	Withdrawal
Water immersion	Water facilitates insertion. Gas (air or CO ₂) may be used	Gas used on withdrawal. Most infused water suctioned on withdrawal
Water exchange	Water infused and exchanged to allow progression in clear water. Gas pockets removed. No gas insufflation.	Gas used on withdrawal

Advantages of Water Assisted Colonoscopy

First, the use of Water assisted colonoscopy during insertion is associated with less patient discomfort when compared to gas insufflation colonoscopy. A Cochrane meta-analysis including 11 RCT's with 1922 patients, compared the effect of WI and WE grouped together and AI on pain (10), and revealed a reduction in maximum

pain score by -1.57 (95% CI -2.00 to -1.14, $P<0.001$) in the WI group compared with the AI group. In all included studies, pain scores were lower with water assisted than in air insufflation. The MD in maximum pain scores was greatest in participants without any analgesia/sedation (-2.38, 95% CI -2.94 to -1.81, $P<0.001$).

Second, Water exchange colonoscopy is associated with the highest quality of bowel cleanliness. A systematic review and meta-analysis (11) reported that the pooled estimates of bowel cleansing as evaluated by mean Boston Bowel Preparation Score (BBPS) of four insertion techniques (WE, WI, AI and CO₂ insufflation) derived from 6 studies using split-dose preparation were 7.4 (95% CI, 7.0-7.8) for WE, 7.0 (95% CI, 6.5-7.5) for WI, 6.8 (95% CI, 6.3-7.3) for AI, and 7.3 (95% CI, 7.0-7.6) for CO₂ insufflation. WE performed significantly better than AI (MD, 0.68; 95% CI, 0.34-1.02) and WI (MD, 0.41; 95% CI, .04-.78). WE and CO₂ insufflation were comparable (MD, 0; 95% CI, -0.80 to 0.82). WI was comparable with both AI and CO₂ insufflation.

Finally, Water exchange colonoscopy is associated with higher adenoma detection rate than gas insufflation colonoscopy. In a recent multicenter randomized controlled trial (RCT) with 3303 patients (screening, surveillance and symptomatic), in the WE arm overall (any indication) ADR (18.3% vs 13.4%, $P<0.001$) in all segments of the colon, as well as ADR in screening patients ≥ 50 years (29.4% vs 22.9%, $P=0.04$), were significantly higher than AI. WI was comparable to AI for ADR. (12)

Disadvantages of WAC

There is a learning curve for WE colonoscopy of about 50-100 cases. Moreover, WE increases total procedure time by mean of 2 minutes (9). There is also a concern regarding the risk of hyponatremia due to water infusion.

Clinical utility of WAC in therapeutic colonoscopy

1) Underwater Endoscopic Mucosal Resection (UEMR)

Binmoeller *et al* (13) first described underwater EMR (UEMR) of large colon polyps using the WI method. UEMR is also useful in difficult polypectomy as. UEMR eliminates the need for submucosal injection and is useful for salvage treatment of recurrent adenomas with fibrosis after piecemeal EMR. Compared with conventional EMR, UEMR increases the proportion of complete resection of medium- to large-sized lesions, and reduces the proportion of recurrences, post treatment bleeding, transmural burns, and perforation (13). Since water does not affect the conductivity of the tissue during polypectomy, cold as well as hot snare polypectomy can be safely executed in a water-filled lumen. Water acts as a heat sink and prevents direct contact of the polyp tip with the nearby colonic wall; thus, UEMR can minimize the risk of mucosal burns during polypectomy. UEMR is a relatively simple and safe method for the removal of large colorectal lesions.

2) Sigmoid volvulus

Sigmoid volvulus occurring due to a long, redundant and elongated sigmoid mesocolon is one of the most common causes of acute large bowel obstruction. Sigmoid volvulus (SV) has a high associated mortality rate commonly seen in elderly patients. The therapeutic management of SV remains controversial and can be classified into nonsurgical and surgical treatment. Endoscopic Detorsion (14) is an expected alternative to surgical management in elderly patient with high surgical mortality risk, however is associated with high rates of recurrences. (Figure 3)

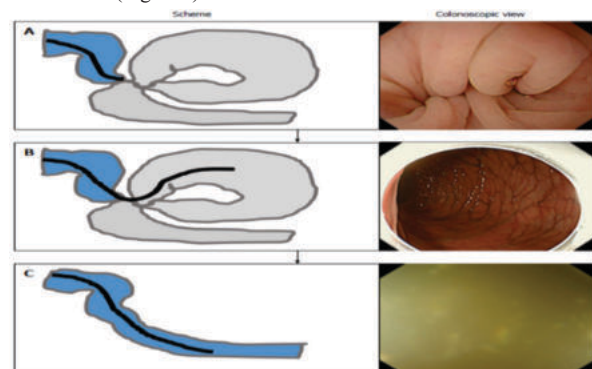


Figure 3: Scheme and colonoscopic view during endoscopic detorsion of sigmoid volvulus.

A: The twisted colonic segment under water; B: After passing through the point of obstruction, the distended lumen of the sigmoid colon appears and endoscopic suction decompresses the lumen; C: After detorsion, aqueous stool flows out from the oral side.

3) Lower gastrointestinal bleeding

In a water-filled lumen, the blood from the bleeding site streams into the water, making it easy to pinpoint the site of bleeding for treatment. However, large prospective studies are needed to determine the feasibility of WI colonoscopy for locating and treating postoperative gastrointestinal bleeding.

CONCLUSION

WAC can be utilized as an adjunct to AI colonoscopy and can be performed by practising colonoscopists using standard equipment, water jet and suction devices. WAC helps in improving overall patients acceptability to colonoscopy by reducing loop formation, procedural and post procedural pain and discomfort, mitigate sedation related morbidities and in turn helps in improving mucosal inspection, BBPS and ADR. Moreover, various therapeutic underwater procedures including underwater polypectomy, UEMR/ESD are deemed safe and efficacious.

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