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EDUCATION IN PRACTICE

My approach to water-assisted colonoscopy

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ABSTRACT

The goal of diagnostic colonoscopy is to achieve procedural completion while maximising effectiveness, patient acceptance and safety. In recent years, international interest in water-assisted colonoscopy (WAC) has been steadily gathering pace. A plethora of high-quality randomised controlled trials and meta-analyses now offer incontrovertible evidence into the benefits of WAC, both for the endoscopist and the patient. Despite this, uptake of WAC within the UK has been limited, with the lack of educational resources representing a significant barrier. This practical step-by-step guide is aimed at both existing practitioners and trainees, with a view to promoting familiarity with WAC and potentially for incorporation into daily practice which may ultimately have a positive effect on quality of colonoscopy and patient experience.

BACKGROUND

In recent years, interest in water-assisted colonoscopy (WAC) has been gathering pace, spurred by the explosion of high-quality studies which now offer incontrovertible evidence into the benefits of WAC to both the endoscopist and the patient.¹⁻⁶ The benefits of WAC arise from two principal mechanisms: (1) use of water exerts a gravitational effect and reduces colonic elongation, thereby reducing loop formation, procedure discomfort and sedation requirements,⁷ (2) water irrigation improves mucosal views and can increase adenoma detection rates (ADR).¹⁻⁶ The learning curve is relatively short; WAC may be grasped by existing practitioners after 50 procedures⁵ and can expedite competency acquisition in novice trainees.⁸ Despite this, uptake of WAC within the UK has been limited, with the lack of educational resources representing a potential barrier. Herein, we provide a pragmatic guide which could be used by endoscopists to implement WAC into their daily practice, with the aim to ultimately improve quality of colonoscopy.

DEFINITIONS

WAC is a colonoscopy procedure which uses water as the main insufflation method. WAC encompasses:

- Water immersion (WI): insufflation with water and suction of luminal air on intubation. On withdrawal, water is suctioned and air/CO₂ insufflation used as per standard practice.
- Water exchange (WE): simultaneous water infusion and suction of air and dirty (opaque) luminal contents during insertion, until distention with transparent water is achieved. This is the gold standard WAC technique, as supported by literature to date.
- Modified/limited WAC, for example, confined to the left colon.
- Total WAC: entire procedure performed with water only.

PREPARATION**Online resources**

Before trialling WAC, readers should review the following online resources: (1) an illustrated guide on the effect of water on colonic anatomy,⁹ and (2) a video demonstration by Cadoni and Ishaq.¹⁰

Equipment

WAC can be performed using pre-existing colonoscopes and equipment, with the addition of a standard irrigation pump. A dedicated water channel is desirable but not essential as it facilitates WE by enabling the simultaneous infusion of clean water and suctioning of 'dirty' fluid. For colonoscopes without this feature, irrigation may be connected to the suction port, but this precludes simultaneous infusion and suction. Irrigation tubing is connected to a standard 1 L bottle containing water between room and body temperature.¹¹ Air within the irrigation system should be expunged during testing.

The water pump rate should be adjusted according to technique; those who



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perform simultaneous infusion and suction should maximise infusion rates to deliver net positive water balance.

Attachment of a distal transparent cap may reduce caecal intubation times by minimising mucosal suctioning and red-outs,¹² but can also reduce field of view. Other attachments, for example, Endocuff, have not been studied in WAC.

For beginners, we recommend switching off CO₂ once endoscope function is checked. Subconscious or overzealous CO₂ insufflation can obviate the benefits of WAC in loop/angulation formation and cause discomfort.

Consent

Eighty per cent of our WAC procedures are performed unsedated with or without the use of nitrous oxide. The technique does not confer additional procedural risk. Patients should be consented for a standard colonoscopy. For uncomplicated patients desiring sedation, we discuss the benefits of unsedated WAC. Most patients do agree to forgo sedation, with 95% of patients willing to undergo repeat unsedated WAC after the procedure.⁴

Planning

Standard preprocedural preparations apply, including review of indications, contraindications and previous endoscopic or radiological investigations. Enquiring about compliance and efficacy of bowel preparation may indicate whether WE/colonoscopy is feasible. Preprocedure checklists reduce error rates and should be completed. As with all endoscopic procedures, background music may help.¹³

Positioning

Starting the procedure in the left lateral position is beneficial as the gravitational effect of infused water pools in the sigmoid–descending colon and tends to straighten the rectosigmoid junction.⁷ Line the bed with disposable waterproof pads in case of water leakage. Ergonomically, it is optimal to position the foot pump to the left of the endoscopist. It is advisable to assign one foot for the foot pump (eg, left foot) and the other for diathermy pedals. The bed should be positioned at waist height and the monitor within optimal distance.¹⁴

INSERTION

General principles

Prior to insertion, apply ample lubrication to the anal canal and colonoscope. Advance the colonoscope approximately 2–3 cm through the rectal ampulla, as water insufflation distal to this can lead to anal leakage. Position the colonoscope tip centrally within the lumen and gently infuse water. Pause to assess the quality of bowel preparation. WE should be first line: infuse water, either in pulses (IB) or continuously (KS)

and apply concomitant suction to clear gas pockets and opaque water until a clear view is obtained. Direct the water jet to wash off coated mucosa. If visibility is poor despite patience with initiating WE (20–30 s), switch to WI or CO₂ insufflation (if solid stools) until mucosal views improve.

Suctioning is an important skill and should be applied to pockets of air and residual stool (WE). Beginners may be frustrated with inadvertent suctioning of the mucosa. This can be minimised by slightly deflecting the tip to the 11 o'clock position (opposite the typical five o'clock position of the suction channel) before suctioning,¹⁰ or by using a cap.

Advance the colonoscope gently while applying principles of loop prevention, that is, frequent withdrawals with to-and-fro motions to keep the colonoscope straight, avoid excessive tip angulation, apply torque and ensure one-to-one movement. If resistance is encountered, check the magnetic endoscope imager or scope distance for looping, pull back and reconsider a different approach. Torque should be reapplied on intubation and abdominal pressure or position change considered to avoid loop recurrence. It may be necessary to resolve and externalise loops.

If polyps are detected, consider marking them, for example, applying suction mark, biopsy or tattoo. Alternatively, for minute lesions, resect during intubation (KS) to avoid missing them on withdrawal.

Converse with the patient. In addition to providing distraction and information on WAC, patients may disseminate positive experiences and drive engagement with colonoscopy.

Distal colon

At the distal colon, similar principles to standard colonoscopy apply, but with emphasis on water infusion, scope-tip positioning and suctioning. There should be net water infused at the rectosigmoid junction (KS: 200 mL+) to allow the gravity of water to straighten the rectosigmoid bend and minimise looping.

Hysterectomy and diverticular segments may pose a challenge. Occasionally, the lumen may fail to distend with water; limited bursts of CO₂ may be required to identify the lumen. Dedicate up to 50% of the insertion time towards negotiating the distal colon.

Transverse colon

Proactively turning the patient to the supine position at the splenic flexure allows redistribution of water down the transverse colon. Use of the stiffener, diaphragmatic splinting with deep inhalation, or sigmoid pressure may assist colonoscope advancement.

In the case of suboptimal bowel preparation or time constraints, consider switching to WI or CO₂ insufflation. Use of WI minimises proximal colonic distention and transverse loop formation. At the mid-transverse colon, anticlockwise torque may be required. It may be prudent to reapply externalised loops back into the colon.

Proximal colon

The textbook position for entering the hepatic flexure is the left lateral position.¹⁵ Once traversed, perform judicious WE at the caecal pole as this is a high-risk area for missed pathology. Begin suctioning; consider adding simethicone to the water bottle if bubbles persist. Identify the caecal landmarks and photodocument the appendiceal orifice, caecal pole and the ileocaecal valve.¹⁶ It is advisable to turn to the right lateral position to improve caecal views. This also facilitates terminal ileum (TI) intubation which should be performed routinely (KS). The endoscopist may be guided by the ileocaecal valve and the appendiceal 'bow-and-arrow sign'.¹⁵ Position the ileocaecal valve at nine o'clock (or six o'clock), slowly withdraw the tip back from the appendix, decompress the caecum and apply anticlockwise torque and left wheel angulation to slip into the TI. WI can accentuate the ileal villi for inspection and photodocumentation.¹⁷ On exiting the TI, commence the withdrawal timer.

WITHDRAWAL

Hyoscine (Buscopan) may improve ADR, but lacks evidence in WAC. The blind spot between the appendiceal orifice and ileocaecal valve should be inspected. Caecal retroversion increases polyp yield and should be attempted.¹⁸ At the ileocaecal valve, advance the scope, maximise angulation with both wheels before pulling back. Once the retroverted view is seen, pull back towards the hepatic flexure. With the patient in the right lateral position, re-advance the scope to the caecal pole for a second look in a different position.¹⁹

On withdrawal, ensure adherence to the ≥ 6 min (ideally ≥ 10 min) withdrawal time.¹⁶ The cleaner views afforded by WE will minimise the need for washing mucosa, allowing focus on polyp detection.²⁰ Nevertheless, all residual faecal coating should be washed which may uncover sessile serrated lesions.

Ensure colonic insufflation with CO₂ and suctioning of contents after completing each segment. Rectal retroflexion should be performed.¹⁸

In addition to standard components of report writing, use of the WI/WE method and the volume of fluid suctioned should be stated.

WATER-ASSISTED POLYPECTOMY

Water-assisted polypectomy (WAP) is safe and effective,²¹ obviating the need for submucosal resection. Detailed discussion is beyond the scope of this article. WAP is especially useful for pedunculated polyps, where water can lift a polyp head over the snare and aid positioning, but also aids piecemeal procedures, allowing remnant polyp tissue to float and facilitate tissue grasping with the snare.

FAILED PROCEDURES

Several considerations may help in the case of completion failure:

1. Change endoscope: a paediatric colonoscope or gastroscoposcope may allow negotiation of a fixed pelvis with adhesions.
2. Consider more water: enhanced gravitational effect.
3. Consider reinsertion in an alternate position, for example, right lateral/prone, along with using targeted external pressure as directed by the magnetic endoscope imager where available.
4. Optimise sedation and consider rescheduling under a more experienced endoscopist and/or propofol list.

SUMMARY

WAC can be performed by existing colonoscopists using standard equipment but requires motivation and modification of existing technique.²⁰ Water insufflation can hamper luminal views on intubation and requires precise suctioning technique and tip control fluency. For beginners, efforts at WE, higher rates of adenoma yield and subsequent polypectomy will impact on procedure time; this improves once competency is achieved.² A recent meta-analysis showed that WE was associated with an average additional procedure time of 1.8 min.³ In return, WAC can reduce loop formation and procedural discomfort, mitigate sedation-related risks, improve mucosal views and ADR, and increase overall patient satisfaction. For endoscopists who are willing to adapt their technique, WAC can be feasibly implemented to improve overall quality of colonoscopy and patient experience.

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REFERENCES

- 1 Fuccio L, Frazzoni L, Hassan C, *et al*. Water exchange colonoscopy increases adenoma detection rate: a systematic review with network meta-analysis of randomized controlled studies. *Gastrointest Endosc* 2018;88:589–97.
- 2 Cadoni S, Falt P, Gallittu P, *et al*. Water exchange is the least painful colonoscope insertion technique and increases completion of unsedated colonoscopy. *Clin Gastroenterol Hepatol* 2015;13:1972–80.
- 3 Cadoni S, Hassan C, Frazzoni L, *et al*. Impact of water exchange colonoscopy on endoscopy room efficiency: a

- systematic review and meta-analysis. *Gastrointest Endosc* 2018;32861-X.
- 4 Jia H, Pan Y, Guo X, *et al*. Water exchange method significantly improves adenoma detection rate: a multicenter, randomized controlled trial. *Am J Gastroenterol* 2017;112:568-76.
 - 5 Azevedo R, Leitão C, Pinto J, *et al*. Can water exchange improve patient tolerance in unsedated colonoscopy a prospective comparative study. *GE Port J Gastroenterol* 2018;25:166-74.
 - 6 Hafner S, Zolk K, Radaelli F, *et al*. Water infusion versus air insufflation for colonoscopy. *Cochrane Database Syst Rev* 2015:CD009863.
 - 7 Asai S, Fujimoto N, Tanoue K, *et al*. Water immersion colonoscopy facilitates straight passage of the colonoscope through the sigmoid colon without loop formation: randomized controlled trial. *Dig Endosc* 2015;27:345-53.
 - 8 Siau K, Hawkes ND, Dunckley P. Training in endoscopy. *Curr Treat Options Gastroenterol* 2018;16:345-61.
 - 9 Colon Explorer. The Water Immersion Technique for Colonoscopy Insertion. 2018 <http://www.endoscopy-colon-explorer.com/the-water-immersion-technique-for-colonoscopy-insertion/> (cited 5th Nov 2018).
 - 10 Cadoni S, Ishaq S. How to perform water-aided colonoscopy, with differences between water immersion and water exchange: a teaching video demonstration. *VideoGIE* 2018;3:169-70.
 - 11 Falt P, Šmajstrla V, Fojtík P, *et al*. Cool water vs warm water immersion for minimal sedation colonoscopy: a double-blind randomized trial. *Colorectal Dis* 2013;15:e612-7.
 - 12 Tseng CW, Koo M, Hsieh YH. Cecal intubation time between cap-assisted water exchange and water exchange colonoscopy: a randomized-controlled trial. *Eur J Gastroenterol Hepatol* 2017;29:1296-302.
 - 13 Wang MC, Zhang LY, Zhang YL, *et al*. Effect of music in endoscopy procedures: systematic review and meta-analysis of randomized controlled trials. *Pain Med* 2014;15:1786-94.
 - 14 Segal JP, Kanagasundaram C, Mills P, *et al*. Polyp detection rate: does length matter? *Frontline Gastroenterol* 2019;10:107-12.
 - 15 Wayne JD, Thomas-Gibson S. How I do colonoscopy. *Gastrointest Endosc* 2018;87:621-4.
 - 16 Rees CJ, Thomas Gibson S, Rutter MD, *et al*. UK key performance indicators and quality assurance standards for colonoscopy. *Gut* 2016;65:1923-9.
 - 17 Powell N. The use of cecal and terminal ileal images for verifying the completion of colonoscopy. *Gastroenterol Hepatol* 2011;7:536-9.
 - 18 Rex DK, Vemulapalli KC. Retroflexion in colonoscopy: why? where? when? how? what value? *Gastroenterology* 2013;144:882-3.
 - 19 Clark BT, Parikh ND, Laine L. Yield of repeat forward-view examination of the right side of the colon in screening and surveillance colonoscopy. *Gastrointest Endosc* 2016;84:126-32.
 - 20 Siau K, Cadoni S. Colonoscope insertion: is the future underwater. *GE Port J Gastroenterol* 2018;25:163-5.
 - 21 Siau K, Ishaq S, Cadoni S, *et al*. Feasibility and outcomes of underwater endoscopic mucosal resection for ≥ 10 mm colorectal polyps. *Surg Endosc* 2018;32:2656-63.