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REVIEW

Simethicone use during gastrointestinal endoscopy: Position statement of the Gastroenterological Society of Australia

Benedict M Devereaux,*,† Andrew C F Taylor,† Eugene Athan,‡,§ David J Wallis,† Robyn R Brown,¶ Sue M Greig,** Fiona K Bailey,† Karen Vickery,†† Elizabeth Wardle¶ and Dianne M Jones¶

*Medical School, University of Queensland, Brisbane, Queensland, †Gastroenterological Society of Australia, Melbourne, ‡Barwon Health, Deakin University, Geelong, ¶Gastroenterological Nurses College of Australia, Beaumaris, Victoria, §Australasian Society of Infectious Diseases, **Australasian College for Infection Prevention and Control, Hobart, Tasmania, and ††Australian School of Advanced Medicine, Macquarie University, Sydney, New South Wales, Australia

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Correspondence
Benedict Devereaux, Department of Gastroenterology, University of Queensland, Royal Brisbane and Women's Hospital, Level 9, Ned Hanlon Building, Butterfield Street, Herston, QLD 4029.
Email: bdevereaux@ddq.net.au

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Abstract

Concern has been raised regarding the use of simethicone, a de-foaming agent, during endoscopic procedures. Following reports of simethicone residue in endoscope channels despite high level disinfection, an endoscope manufacturer recommended that it not be used due to concerns of biofilm formation and a possible increased risk of microorganism transmission. However, a detailed mucosal assessment is essential in performing high-standard endoscopic procedures. This is impaired by bubbles within the gastrointestinal lumen. The Gastroenterological Society of Australia's Infection Control in Endoscopy Guidelines (ICEG) Committee conducted a literature search utilizing the MEDLINE database. Further references were sourced from published paper bibliographies. Following a review of the available evidence, and drawing on extensive clinical experience, the multidisciplinary ICEG committee considered the risks and benefits of simethicone use in formulating four recommendations. Published reports have documented residual liquid or crystalline simethicone in endoscope channels after high level disinfection. There are no data confirming that simethicone can be cleared from channels by brushing. Multiple series report benefits of simethicone use during gastroscopy and colonoscopy in improving mucosal assessment, adenoma detection rate, and reducing procedure time. There are no published reports of adverse events related specifically to the use of simethicone, delivered either orally or via any endoscope channel. An assessment of the risks and benefits supports the continued use of simethicone during endoscopic procedures. Strict adherence to instrument reprocessing protocols is essential.

Introduction and background

In performing endoscopic procedures to the highest standard, it is essential that a detailed mucosal assessment is undertaken. Bubbles within the gastrointestinal lumen can significantly impair mucosal assessment, lesion detection, and lengthen procedural duration. Simethicone is commonly used as a de-foaming agent during endoscopic procedures. Concerns regarding simethicone use during gastrointestinal endoscopy have been circulating for several years. Despite this, there is no comparable, alternative substance. Recently, Olympus Corporation distributed a letter to customers in the USA warning of the use of simethicone during gastrointestinal endoscopic procedures.[1] This has resulted in heightened focus on the use of simethicone. The letter stated, "Olympus does not recommend the use of non-water-soluble additives with our flexible endoscopes or ancillary equipment. These products may be difficult to remove during manual cleaning and may reduce the efficacy of the reprocessing procedure. Simethicone and petroleum/oil/silicone-based lubricants are non-water soluble and thus not recommended for use by Olympus." Olympus America had earlier raised concern regarding the use of simethicone in a letter to customers in 2009.[2] Peak international gastroenterology bodies have published position statements on the use of simethicone. The European Society of Gastrointestinal Endoscopy recommends adding simethicone to standard bowel preparation for colonoscopy.[3] The American Society for Gastrointestinal Endoscopy, in an update on the use of simethicone in 2016, concluded there was insufficient evidence to recommend a change to current clinical practice.[4] The British Society of Gastroenterology advised in 2017 that the concentration of simethicone be kept to a minimum and that it be administered orally or via the biopsy port and not via the water bottle or flushing pump.[5] Most recently, the Canadian Association of Gastroenterology concluded it was unable to make clear recommendations on the use of simethicone at this time.[6]

Methods

Computerized medical literature searches were undertaken using MEDLINE, utilizing search terms "endoscopy," "gastrointestinal endoscopy," "gastroscopy," "colonoscopy," "adenoma detection rate," and "simethicone" up until September 2018. Cross

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referencing was performed using the "similar articles" function, and further references were sourced from published paper bibliographies and recommendations from Committee members. Following this review of the available evidence, and drawing on extensive clinical experience, the multidisciplinary Infection Control in Endoscopy Guidelines Committee of the Gastroenterological Society of Australia considered the risks and benefits of simethicone use in formulating four recommendations (Table 1). B. D. conducted the literature search, formulated the initial recommendation statements, wrote the first draft of the manuscript, and chaired the Infection Control in Endoscopy Committee. The recommendations were reviewed and discussed at face to face meetings and electronically by all authors (B.D., A.T., E.A., D.W., R.B., S.G., F.B., K.V., E. W., and D.J.). An iterative process was used to reach agreement on the final recommendations and the content and structure of the manuscript. B.D. and A.T. revised the document to achieve the final version. The evidence level was determined for each recommendation as was the recommendation grade (Appendix A).[7] The recommendations were reviewed and approved by the relevant committees and boards of the Gastroenterological Society of Australia (September 2018), the Gastroenterological Nurses College of Australia (September 2018), and the Australasian College of Infection Prevention and Control (February 2019).

Recommendations

1 The continued use of simethicone is considered reasonable as it improves mucosal inspection during gastroscopy and colonoscopy and likely facilitates adenoma detection at colonoscopy. Evidence Level: IA, Recommendation Grade: A

In performing endoscopic procedures to the highest standard, it is essential that a detailed mucosal assessment is undertaken. Bubbles within the gastrointestinal lumen can significantly impair mucosal assessment, lesion detection, and lengthen procedural duration. Continued lavage of luminal bubbles with water does not consistently result in improved mucosal assessment and can result in increased bubble formation. Published studies have shown simethicone use during gastroscopy improves mucosal visibility[8–12] and may reduce procedure time.[9,12] A recently published meta-analysis of seven randomized controlled trials involving 1099 patients undergoing gastroscopy for diagnostic indications demonstrated that pre-procedure simethicone ± *N*-acetylcysteine improves mucosal visualization and mucosal visualization scores.[13] In respect of colonoscopy, a recent prospective, multicenter, randomized control trial reported a significantly increased adenoma detection rate when simethicone was administered with polyethylene glycol at the time of colonoscopy preparation.[14] Cecal intubation time was reduced, and right colon adenoma detection rate was significantly higher in another prospective, multicentre, randomized trial when simethicone was added to low volume polyethylene glycol colonoscopy preparation.[15] Of particular note, a recently published Australian study reported a 10% increase in the polyp detection rate when simethicone is added to the auxiliary water pump during colonoscopy.[16]

2 The smallest effective quantity of simethicone should be added to lavage fluid. A suggested, yet untested concentration, would be 2–3 mL of 120 mg/mL simethicone added to 1 L of sterile water-(0.024-0.036% (g/100ml, w/v)). Evidence Level: IV, Recommendation Grade: D

Simethicone is an inert substance that is not soluble in water or alcohol.[17] Proprietary agents frequently contain sugars, thickeners, and binding agents.[18] Studies have documented residual simethicone in gastroscope and colonoscope biopsy channels.[18,19] In the most recent study, simethicone residue was identified during borescope inspection of biopsy channels when used at concentrations ranging from 0.033-0.2% (g/100ml, w/v).[19] Simethicone crystals have been detected in colonoscope water jet channels, despite adherence to reprocessing protocols.[20] It is feasible that residual simethicone in endoscope channels could promote biofilm formation and thereby increase the risk of transmission of microorganisms. These findings have resulted in significant concern regarding the ongoing use of this agent. We recommend the addition of the smallest effective dose of simethicone to sterile water. Whereas no published data are available to determine the lowest, effective dose of added simethicone, a recent study presented in abstract form, utilized an *in vitro* experimental model to suggest that a dose as low as 20 mg/100 mL (0.02 g/100 mL, 0.02% w/v) is sufficient to abolish or prevent bubble formation.[21] Based on the committee's extensive clinical experience, we recommend the use of 2–3 mL of 120 mg/mL simethicone added to 1 L of sterile water resulting in a concentration range of 0.024–0.036% (g/100 mL, w/v). The simethicone solution should be very slightly opaque. Further research is required to determine the lowest effective simethicone dose and examine the frequency and significance of simethicone residue in endoscope channels and the feasibility and utility of borescope examination of suction/biopsy channels in clinical practice.

3 Simethicone may be administered orally or through any endoscope irrigating channel. Evidence Level: IV, Recommendation Grade: D

Table 1 Recommendations

1. The continued use of simethicone is considered reasonable as it improves mucosal inspection during gastroscopy and colonoscopy and likely facilitates adenoma detection at colonoscopy. Evidence Level: IA, Recommendation Grade: A
2. The smallest effective quantity of simethicone should be added to lavage fluid. A suggested, yet untested concentration, would be 2–3 mL of 120 mg/mL simethicone added to 1 L of sterile water (0.024-0.036% (g/100ml, w/v)). Evidence Level: IV, Recommendation Grade: D
3. Simethicone may be administered orally or through any endoscope irrigating channel. Evidence Level: IV, Recommendation Grade: D
4. Strict adherence to instrument reprocessing protocols is essential. We highlight the importance of immediate bedside pre-clean endoscope decontamination that includes post-procedure flushing and prompt commencement of manual or machine cleaning. Evidence Level: IIB, Recommendation Grade: B

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There is very little evidence of the impact of simethicone on endoscope reprocessing effectiveness. Available studies report conflicting findings. In a recent study, borescope examination of the biopsy channels of 59 endoscopic instruments revealed scratches (86%) and channel shredding (59%) after reprocessing and manual forced-air drying. However, in this study, no residual simethicone or biofilm was observed in any examined channel.[22] In the study by Barakat *et al*.,[19] simethicone residue was identified after manual cleaning including brushing and subsequent high-level disinfection.

It is important to note the conflicting qualification stated in the Olympus letter,[1] "Consider administering simethicone either orally or via the biopsy port of the endoscope as the biopsy channel is manually brushed during reprocessing. Avoid administering simethicone via addition to the water bottle or flushing pump. Use these products sparingly by diluting the product as much as possible in order to achieve the desired clinical result". There are no published reports of adverse events due to the use of simethicone through air/water channels or water jet channels. In addition, there are no published data confirming that brushing removes simethicone residue from biopsy channels. There is no evidence base to support limiting the use of simethicone to lavage fluid via the biopsy channel. Indeed, it is reasonable to assume that surface damage that is common in the biopsy channel may result in a higher risk of biofilm formation compared with the air/water and water jet channels. The interaction between simethicone and biofilm is unknown. In summary, there is no evidence that simethicone promotes biofilm formation or conversely that the presence of biofilm promotes simethicone residue in endoscope channels. After assessing the benefits and risks, we consider it important to continue the use of simethicone during gastrointestinal endoscopic procedures to suppress bubble formation and optimize mucosal inspection.

4 Strict adherence to instrument reprocessing protocols is essential. We highlight the importance of immediate bedside pre-clean endoscope decontamination that includes post-procedure flushing and prompt commencement of manual or machine cleaning. Evidence Level: IIB, Recommendation Grade: B

As stated in GESA's recently published Infection Control in Endoscopy Consensus Statements on Carbapenemase-producing Enterobacteriaceae,[23] the most important component of decontamination is timely and meticulous cleaning prior to disinfection. It cannot be overemphasized that adequate and effective cleaning of a used endoscope is essential for reprocessing to be effective. If an instrument is not clean, it cannot be high level disinfected or sterilized. Bedside pre-clean endoscope decontamination should be performed immediately after the instrument is withdrawn from the patient, with the insertion tube wiped clean and the channels lavaged with the suction of a detergent solution and the flushing of the air/water and water jet channels. The greater the time interval an instrument is left uncleaned, the greater the possibility of organic material, or simethicone drying in the channels and tips. This increases the difficulty of removal and the formation of microorganism biofilm. After leak testing, the manual or as is more recently common practice, the automated, brushless cleaning process should commence promptly. In investigating an outbreak of KPC-K pneumoniae, Naas *et al*. determined the likely cause to be delayed pre-wash cleaning and inadequate drying.[24] The GESA Consensus Statements recommend that after initial bedside pre-cleaning, instrument cleaning should commence within 15 min.[23]

Conclusion

Given the evidence of improved quality of endoscopic imaging and polyp detection, without evidence of clinical adverse events over decades of use, we believe that continued use of simethicone is appropriate, and it can be administered through any endoscope channel. We also emphasize that strict adherence to instrument reprocessing protocols is essential.

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Appendix A: Classification of evidence levels and recommendation grades

Level/grade	Description
Evidence level	
IA	Evidence from meta-analysis of RCT's
IB	Evidence from at least 1 RCT
IIA	Evidence from at least 1 controlled study without randomization
IIB	Evidence from at least one other type of quasi-experimental study
III	Evidence from non-experimental descriptive studies, such as comparative studies, correlation studies, and case-controlled studies
IV	Evidence from expert committee reports or opinions or clinical experience of respected authorities, or both
Recommendation grade	
A	Directly based on category I evidence
B	Directly based on category II evidence or extrapolated recommendation from category I evidence
C	Directly based on category III evidence or extrapolated recommendation from category I or II evidence
D	Directly based on category IV evidence or extrapolated recommendation from category I, II, or III evidence

Adapted from Shekelle *et al.*[7]

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