Normal saline solution versus other viscous solutions for submucosal injection during endoscopic mucosal resection: a systematic review and meta-analysis

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Background and Aims: EMR is being increasingly practiced for the removal of large colorectal polyps. A variety of solutions such as normal saline solution (NS) and other viscous and hypertonic solutions (VS) have been used as submucosal injections for EMR. A systematic review and meta-analysis is presented comparing the efficacy and adverse events of EMR performed using NS versus VS.

Methods: Two independent reviewers conducted a search of all databases for human, randomized controlled trials that compared NS with VS for EMR of colorectal polyps. Data on complete en bloc resection, presence of residual lesions, and adverse events were extracted using a standardized protocol. Pooled odds ratio (OR) estimates along with 95% confidence intervals (CI) were calculated using fixed effect or random effects models.

Results: Five prospective, randomized controlled trials (504 patients) met the inclusion criteria. The mean polyp sizes were 20.84 mm with NS and 21.44 mm with VS. On pooled analysis, a significant increase in en bloc resection (OR, 1.91; 95% CI, 1.11-3.29; $P = .02$; $I^2 = 0\%$) and decrease in residual lesions (OR, 0.54; 95% CI, 0.32-0.91; $P = .02$; $I^2 = 0\%$) were noted in VS compared with NS. There was no significant difference in the rate of overall adverse events between the 2 groups.

Conclusions: Use of VS during EMR leads to higher rates of en bloc resection and lower rates of residual lesions compared with NS, without any significant difference in adverse events. Endoscopists could consider using VS for EMR of large colorectal polyps and NS for smaller polyps because there is no significant difference in the outcomes with lesions <2 cm. (Gastrointest Endosc 2017;85:693-9.)

INTRODUCTION

EMR is being widely used for the removal of large colorectal polyps.[1,2] Submucosal fluid injection is essential to create a fluid cushion between the lesion and the deep layers of the gut wall, thereby assisting the safe and complete en bloc resection of lesions and preventing adverse events such as perforation and bleeding.[1,3] Normal saline solution (NS) is the most standard solution used to achieve submucosal elevation during EMR.[3,4] However, the mucosal lift caused by isotonic NS flattens quickly because of its rapid tissue absorption into the adjacent colonic mucosa, which is the principal technical limitation of EMR using NS.[1,3,5] To improve the feasibility of EMR, other viscous and hypertonic solutions (VS), such as hydroxyethyl starch, sodium hyaluronate solution, 50% dextrose, and succinylated gelatin, have been used to facilitate cushion formation and maintenance of the mucosal elevation.[1,3]

Hydroxyethyl starch is a relatively safe and inexpensive solution, easily available as a volume-expanding solution, and maintains the submucosal cushion longer than NS, avoiding additional injection of solution as demonstrated

Abbreviations: APC, argon plasma coagulation; ESD, endoscopic submucosal dissection; NS, normal saline; PPBS, post-polypectomy burn syndrome; RCT, randomized controlled trial; VS, viscous and hypertonic solutions.

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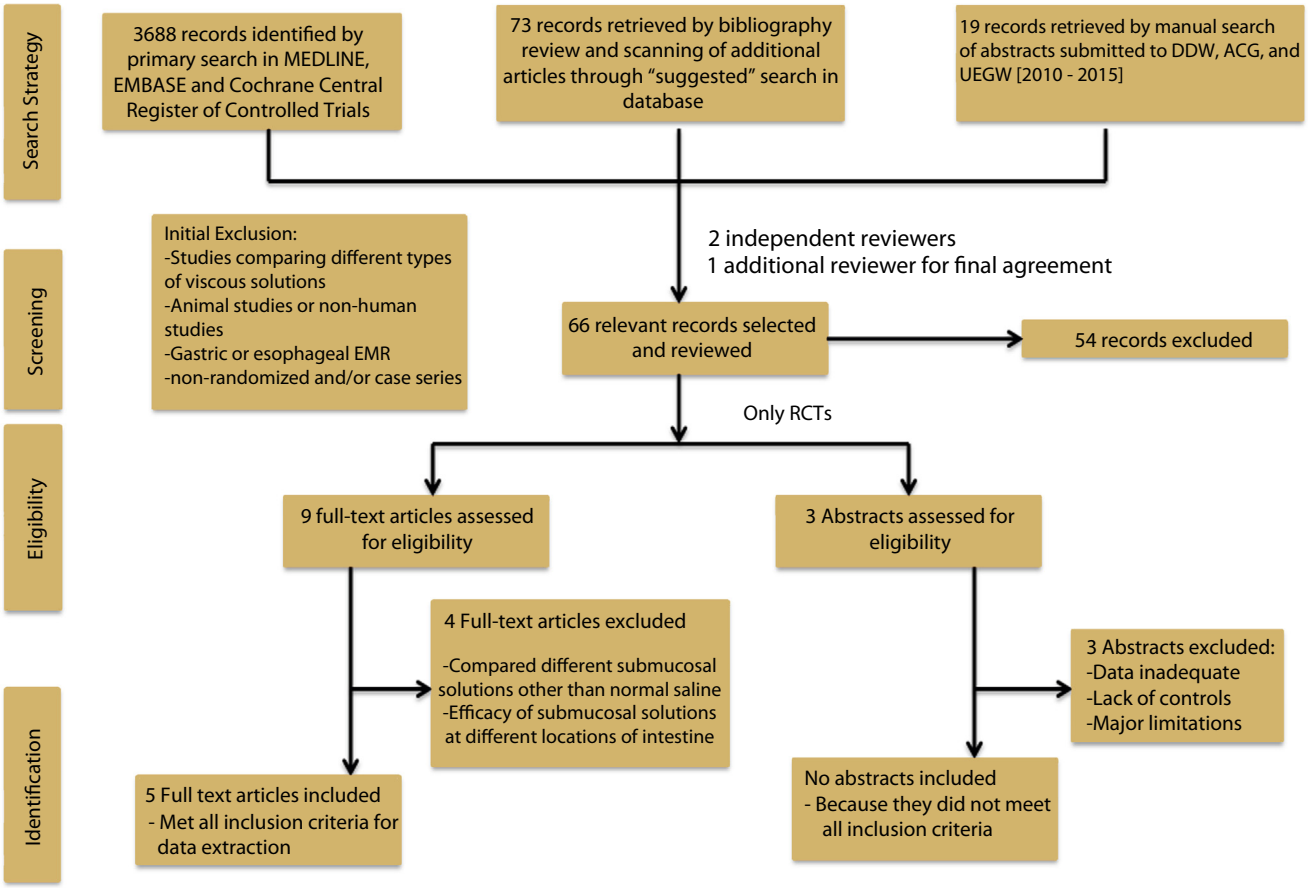

Figure 1. Study flow diagram presenting the methodology for the search strategy, screening, eligibility, and identification of final studies for analysis.

by Fasoulas et al.[4] Sodium hyaluronate is highly viscoelastic, induces a longer-lasting mucosal lift, and is innocuous to mucosal tissue; however, it is expensive.[1,4] Dextrose (50%) is an inexpensive, easily available hypertonic solution, and an ideal alternative for producing and maintaining a more prolonged mucosal elevation.[3] Succinylated gelatin is a clear, inexpensive, safe colloidal solution and enhances the efficiency of EMR by facilitating complete resection and reducing the duration of the procedure.[6]

Even though EMR is now used increasingly for large polypectomy, it has its major limitations. It is inadequate for en bloc resection of polyps larger than 2 cm and adenoma recurrence rates can be up to 20%.[6-9] Research has been ongoing to determine the ideal submucosal injection for EMR to enhance its efficiency. Therefore, we conducted a systematic review and meta-analysis comparing the efficacy and adverse events of EMR using NS versus other viscous solutions.

METHODS

Study selection

Randomized controlled trials (RCTs) including articles and abstracts comparing NS and VS as submucosal injection solution for EMR of colorectal polyps were selected. Studies comparing different types of VS,[5] animal studies,[10-12] gastric[13,14] or esophageal EMR, non-randomized studies, and/or case series were excluded. The literature search was restricted to human studies involving adult patients. Both full-length and abstract publications were selected (Fig. 1).

Literature search and identification of primary studies

All articles comparing NS and VS as submucosal injection for colorectal EMRs were searched irrespective of language, publication (articles or abstracts), and/or results. A 3-way search strategy was adopted. First, a search of MEDLINE, EMBASE, and the Cochrane Central Register of Controlled Trials using PubMed and Ovid as search engines (from 1966 to March 2015) was conducted. The search terms used were "submucosal injection," "endoscopic mucosal resection," "endoscopic submucosal dissection," "colorectal endoscopic mucosal resection," "colon endoscopic mucosal resection," and "normal saline." Second, reference lists of retrieved articles, reviews, and meta-analyses were scanned for additional articles. Third, a manual search of abstracts submitted to Digestive Disease