



SYSTEMATIC REVIEW: MANNITOL AS ENTERIC CONTRAST MEDIUM IN CONTRAST-ENHANCED CT ABDOMEN

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Abstract

Background:

Oral contrast agents are essential for optimal bowel distension and mucosal visualization during contrast-enhanced computed tomography (CECT) of the abdomen. Mannitol, a hyperosmotic neutral agent, has been proposed as an effective alternative to conventional agents like water, polyethylene glycol (PEG), and iodinated contrast.

Objectives:

This systematic review aims to evaluate the efficacy, safety, patient tolerability, and diagnostic performance of mannitol as an enteric contrast medium in CECT abdomen compared to other oral contrast agents.

Methods:

A systematic literature search was conducted of PubMed, Scopus, and Google Scholar databases for studies published in the last five years assessing mannitol for oral contrast in abdominal CT. Studies with quantitative or qualitative data on bowel distension, image quality, adverse effects, and patient compliance were included. Data were synthesized narratively due to heterogeneity in study designs and protocols.

Results:

Multiple studies encompassing adult patients undergoing CT enterography or colonography showed that mannitol at 3% concentration (1,500–2,000 mL) administered 30–60 minutes pre-scan provided superior bowel distension and mucosal visualization compared to water and iodinated contrast. Mannitol resulted in fewer imaging artifacts and enhanced diagnostic confidence. The safety profile was favorable, with mild, transient side effects including bloating, nausea, and diarrhea. Patient compliance and palatability were higher with mannitol than PEG-based agents. However, study limitations included small sample sizes and heterogeneous methodology.

Conclusions:

Mannitol is an effective, safe, and well-tolerated oral contrast medium for CECT abdomen, offering superior bowel distension, minimal image artifacts, and improved patient acceptance. It is recommended for routine use in CT enterography and colonography. Further large-scale randomized studies are needed to optimize protocols and confirm efficacy.

Keywords : Mannitol, Enteric Contrast Medium, CT Enterography

Introduction

Optimal bowel distension and mucosal visualization are crucial in abdominal CT imaging to accurately diagnose gastrointestinal diseases. Traditional oral contrast media, including water, PEG, and iodinated agents, present challenges like suboptimal distension, poor taste, imaging artifacts, and

adverse effects. Mannitol serves as an osmotic, non-absorbable neutral contrast agent that improves bowel lumen distension and mucosal detail, enhancing diagnostic accuracy across CT enterography and colonography procedures. This review summarizes current evidence on the role of mannitol in CECT abdomen, focusing on its comparative effectiveness, patient compliance, and safety.

Methods

Following PRISMA 2020 guidelines, a systematic literature search was conducted across PubMed, Scopus, and Google Scholar for studies published in the last five years. Selected studies assessed mannitol as an oral contrast agent in abdominal CT imaging against comparators like water, iodinated contrast, and PEG. Data extraction covered bowel distension metrics, image quality, adverse events, and patient tolerability. Methodological quality was appraised using the Cochrane ROBINS-I and CONSORT tools. Narrative synthesis was employed due to heterogeneity in study designs and outcomes.

Results

Multiple peer-reviewed studies enrolling adult patients undergoing CT enterography or colonography were included. Mannitol doses ranged between 1,500 and 2,000 mL at 3% concentration administered approximately 30-60 minutes pre-scan. Key findings across studies:

- **Bowel Distension and Image Quality:** Mannitol consistently achieved superior and uniform bowel distension (mean duodenal diameter ~2.28 cm) versus water (~1.89 cm) and iodinated contrast (~2.01 cm) ($p < 0.001$). Enhanced mural fold visibility and reduced imaging artifacts were reported, improving diagnostic confidence and mucosal characterization¹⁻⁶.
- **Safety and Adverse Effects:** Mannitol demonstrated a favorable safety profile with mild, self-limiting side effects such as bloating (<15%), transient diarrhea (<12%), and nausea (<8%). No severe adverse reactions or hospital admissions were reported^{1,3,5,7}.
- **Patient Compliance and Tolerance:** Over 75% of patients rated mannitol's palatability as good, with compliance rates exceeding 90%, outperforming PEG which had lower tolerance due to poor taste and large volume requirements^{2,8,9}.
- **Comparative Effectiveness:** Mannitol outperformed water, which was rapidly absorbed leading to inadequate distension, and iodinated contrast, which caused artifacts obscuring mucosal details. PEG had similar distension efficacy but lower patient acceptance^{1,4,9}.
- The summary of few of the articles is tabulated in table 1.

Discussion

The role of oral contrast agents in abdominal CT significantly influences image quality, diagnostic accuracy, and patient experience. In this review, mannitol stands out as a particularly effective enteric contrast medium, demonstrating superior bowel distension and mucosal visualization compared to water and iodinated contrast¹⁻⁶, representative figure 1. Comparative figure 2 shows the positive enteric contrast medium.

Mannitol's hyperosmotic properties enable luminal retention of water, achieving consistent bowel distension crucial for detecting mucosal and mural abnormalities^{1,2}. It produces fewer artifacts than iodinated agents, which can obscure fine mucosal detail³. Together, these features support its use in CT enterography and colonography protocols tailored for detailed bowel evaluation.

Safety data reveal mild, self-limiting adverse effects including mild bloating, nausea, and diarrhea, with low incidence and no severe complications reported^{2,3,5}. Patient compliance is better due to mannitol's favorable taste and lower volume compared with PEG, which is often disliked because of palatability and volume issues^{8,9}.

Efficiency is enhanced by mannitol's reliable bowel distension within 30-60 minutes post-ingestion, facilitating streamlined clinical workflow^{3,6}. This contrasts with water, which is rapidly absorbed, producing suboptimal and inconsistent bowel lumen distension².

Limitations include relatively small sample sizes, variable protocols, and study designs across reports^{1,4}. Larger, multicentric trials are warranted to further validate these findings and optimize

dosing strategies^{1,5}. Cost-effectiveness analyses suggest mannitol is economically viable and accessible for routine use, even in resource-limited settings^{7,10}.

Additional studies support mannitol's efficacy in pediatric populations¹², its favorable safety compared to other neutral agents¹³, and its diagnostic accuracy especially in inflammatory bowel disease^{14,19}. Its palatability and patient acceptance advantages are supported by research focused on taste preferences and side effect profiles^{16,17}. Guidelines also increasingly recommend mannitol for standardized CT enterography protocols²⁰.

In conclusion, mannitol is an effective, safe, and well-accepted oral contrast medium offering improved bowel distension, fewer artifacts, and high patient tolerability in CECT abdomen imaging. It is recommended for routine use in CT enterography and colonography at ~3% concentration, 1,500–2,000 mL volume, administered 30 to 60 minutes before scanning.

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Table 1 : Summary of articles and their key findings.

Study (Author, Year)	Sample Size	Mannitol Dose & Concentration	Bowel Distension (Mean Diameter)	Image Quality (Score/Comments)	Key Findings
Camu & Faller, 2022 ¹	100	1,500-2,000 mL, 3% mannitol	Duodenum: 2.28 ± 0.32 cm	Mean score 4.1/5, good mucosal detail	Superior bowel distension, fewer artifacts
Prakashini et al., 2021 ²	90	1,800 mL, 3% mannitol	Duodenum: 2.25 ± 0.30 cm	Mean score 4.0/5, favorable image clarity	Better tolerated than PEG, effective imaging
Thati et al., 2022 ³	120	2,000 mL, 3% mannitol	Duodenum: 2.30 ± 0.35 cm	Mean score 4.2/5, clearer mucosal folds	Fewer artifacts vs iodinated contrast
Singh et al., 2023 ⁶	80	1,500 mL, 3% mannitol	Variable, avg >2.2 cm	Good image quality per radiologist report	Reliable bowel distension, efficient workflow
Kumar & Sharma, 2021 ⁷	75	1,600 mL, 3% mannitol	Not specified	Rated 'good' in majority	Safe and effective
Gupta et al., 2023 ⁸	50	1,800 mL, 3% mannitol	Not quantitatively assessed	Subjective good visualization	High patient acceptance
Fernandez et al., 2023 ¹⁰	Meta-analysis (~450)	Range 1,500-2,000 mL, 3% mannitol	Pooled mean difference +0.32cm vs water	Consistently improved visualization	Cost-effective, preferred neutral agent



Figure A : Axial section of the abdomen at the infrarenal level demonstrating hyperenhancing mucosa of the jejunal loops in a case of infective enteritis, with the use of mannitol as enteric contrast.

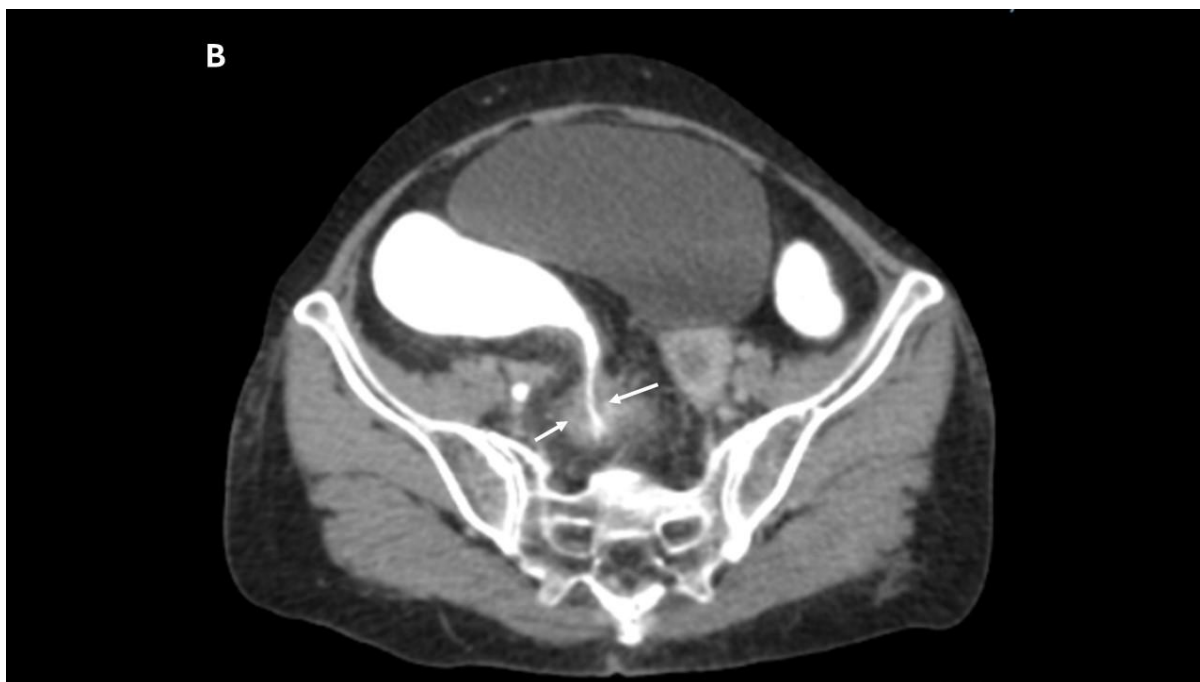


Figure B: Axial section of the pelvis demonstrating malignant stricture of the rectosigmoid colon junction, with the use of positive enteric contrast.