

Comparing Left Colon Mucus Production by Water vs. Saline Filling During Water Exchange Colonoscopy : A Prospective Randomized Controlled Trial

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Background

- Despite human limitations, water exchange (WE) colonoscopy increases adenoma detection rate (ADR) vs. gas insufflation.
- Artificial intelligence (AI) overcomes human limitations and increases ADR but is hampered by false positives (e.g., bubbles, debris, mucus).
- WE improves bowel cleanliness and reduces bubbles and debris.
- WE with water increases left colon mucus production, a potential source of false positives.
- Saline infusion during water-aided colonoscopy reduces left colon mucus production.

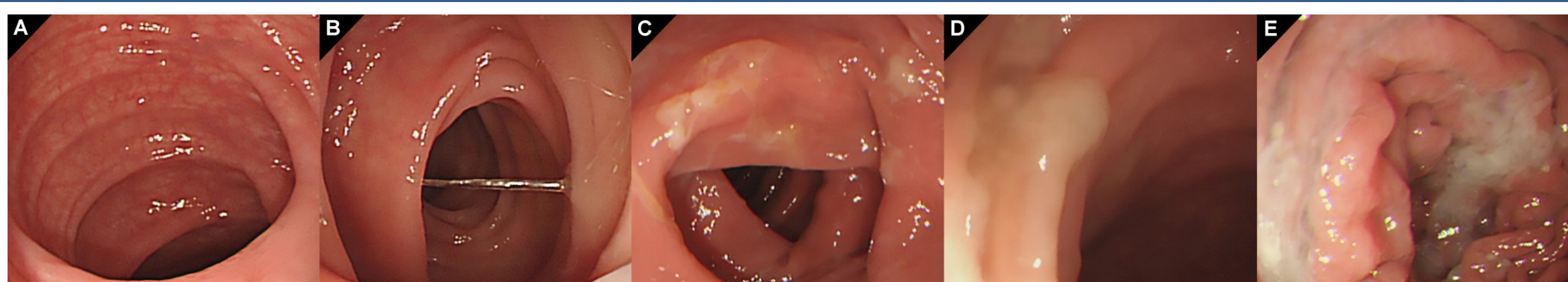
Hypothesis and Study Aims

- Hypothesis:** Saline may produce a dose-dependent inhibition of left colon mucus production.
- Study aims:** To compare the left colon mucus production between WE with water, WE with 25% saline, WE with 50% saline, and carbon dioxide (CO₂) insufflation.
 - Left colon: descending colon, sigmoid colon, rectum.

Methods

- Trial design:** A parallel randomized controlled trial
- Eligibility:** 20-75 years old undergoing routine colonoscopy
- Interventions:** Participants were randomized into four groups to undergo colonoscopic insertion with CO₂ insufflation, WE with water, WE with 25% saline, and WE with 50% saline.
- Warm solution:** All infusates were warmed to approximately 32-33°C unmixed or in 1:3 or 1:1 proportion of normal saline and sterile water, respectively.

Left Colon Mucus Scale (LCMS) Score



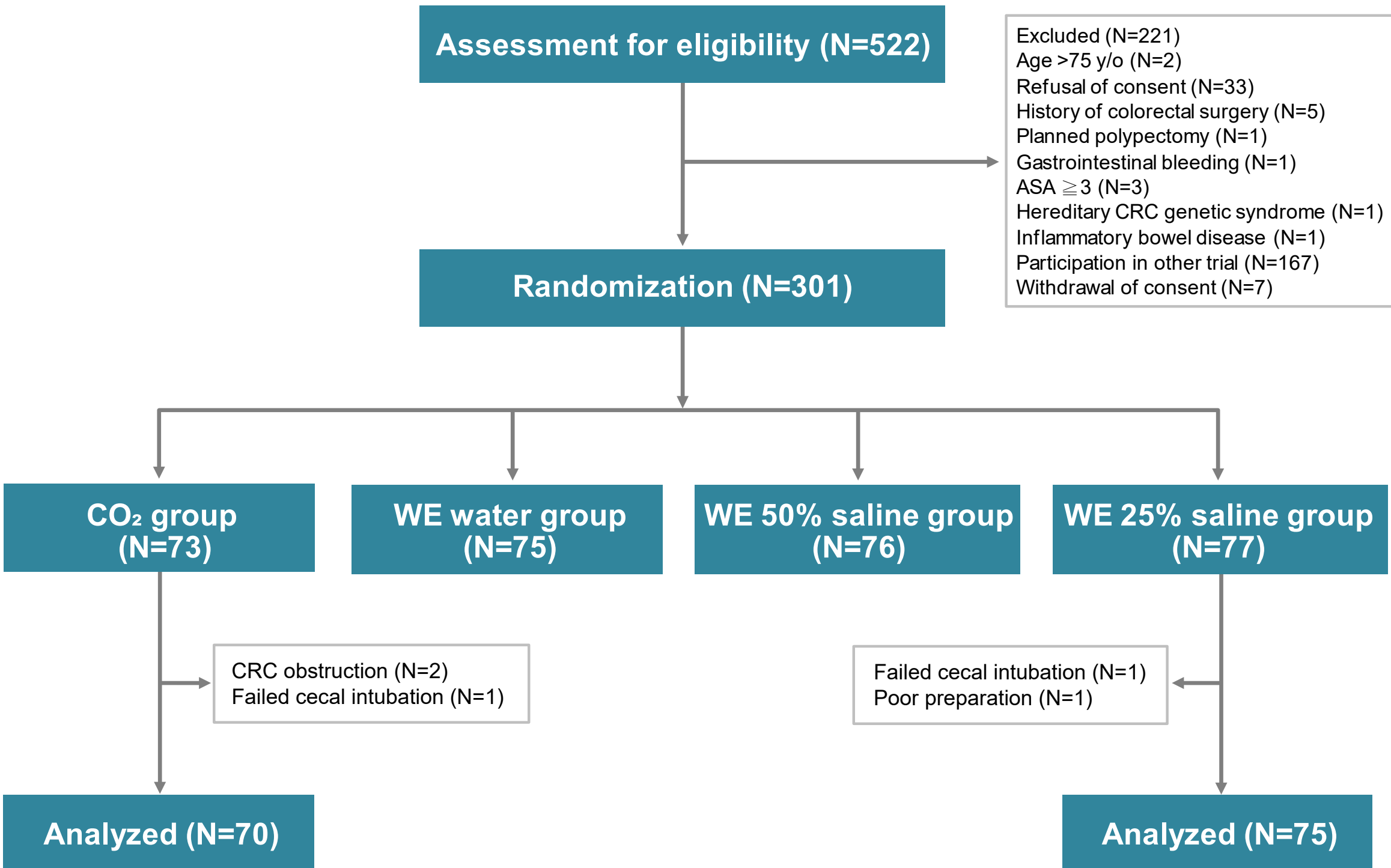
LCMS score:

- (A) Score 0: No mucus
(B) Score 1: Clear mucus
(C) Score 2: Thin opaque mucus
(D) Score 3: Thick opaque mucus covering one side of lumen
(E) Score 4: Thick opaque mucus covering more views of lumen

Outcomes

- Primary outcome:**
 - LCMS score by blinded colonoscopist and study assistant
- Secondary outcomes:**
 - Changes in serum electrolytes (Na, K, Cl) in the WE saline groups
 - ADR and adenomas per colonoscopy (APC)
 - Clinically significant serrated polyp (CSSP) detection rate
 - CSSPs: sessile serrated adenomas/polyps, traditional serrated adenomas, hyperplastic polyps ≥ 10 mm anywhere in the colon, or hyperplastic polyps ≥ 6 mm in the proximal colon

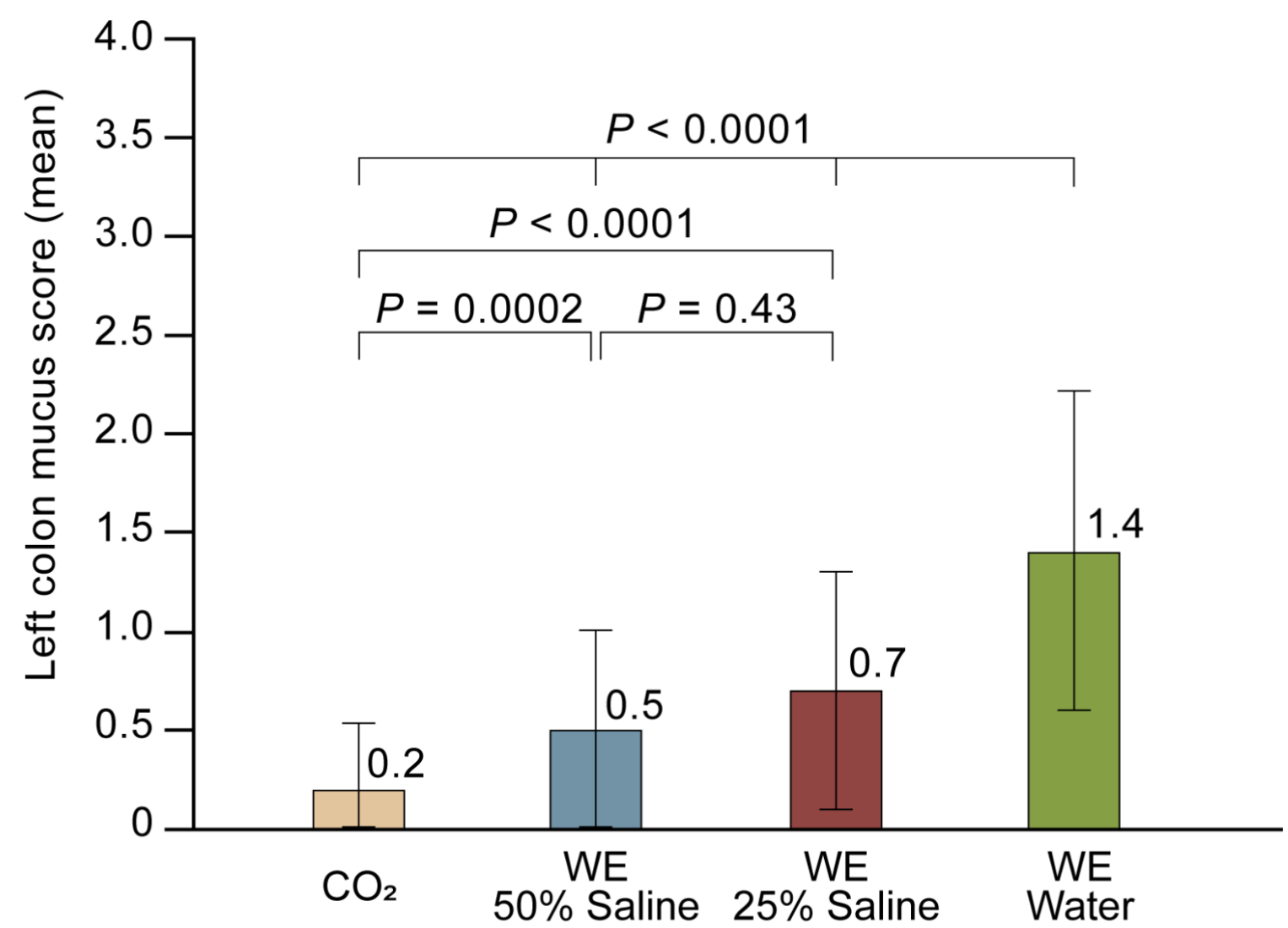
Flowchart



Results: Demographics

	CO ₂ (N=70)	WE water (N=75)	WE 25% saline (N=75)	WE 50% saline (N=76)	Overall P value
Female, n (%)	37 (52.9)	32 (42.7)	38 (50.7)	43 (56.6)	0.3771
Age, mean (SD), years	51.2 (10.0)	51.4 (10.7)	52.0 (10.9)	53.0 (11.5)	0.8346
BMI, mean (SD), kg/m ²	25.0 (4.0)	24.9 (3.5)	24.6 (3.1)	24.8 (4.2)	0.8677
Indication of colonoscopy					0.9955
Screening, n (%)	41 (58.6)	46 (61.3)	42 (56.0)	43 (56.6)	
Surveillance, n (%)	24 (34.3)	24 (32.0)	27 (36.0)	28 (36.8)	
Positive FIT, n (%)	5 (7.1)	5 (6.7)	6 (8.0)	5 (6.6)	

Primary Outcome: LCMS score



Moderate Mucus Production and Need of Additional Mucus Cleansing

	CO ₂ (N=70)	WE water (N=75)	WE 25% saline (N=75)	WE 50% saline (N=76)	Overall P value
Patients with moderate mucus production,* n (%)	0 (0)	32 (42.7)	6 (8.0)	2 (2.6)	<0.0001
Patients who required additional mucus cleansing during withdrawal, n (%)	0 (0)	5 (6.7) [‡]	2 (2.7)	0 (0) [‡]	0.0136

*Moderate mucus production was defined as a mean LCMS score ≥ 2.

[‡]P = 0.032

Colonoscopy Procedural Data

Variables presented as mean (SD)	CO ₂	WE water	WE 25% saline	WE 50% saline	P value
Insertion time, min	10.0 (6.0)	18.0 (6.2)	18.6 (9.1)	18.4 (7.1)	<0.0001
Withdrawal cleansing time, min	4.2 (3.7)	2.5 (2.0)	2.7 (2.5)	2.1 (1.8)	0.0024
Withdrawal inspection time, min	20.2 (6.4)	17.1 (5.4)	16.6 (5.4)	17.2 (5.3)	0.0005
Total procedure time, min	37.6 (11.4)	40.6 (10.6)	40.0 (12.8)	41.1 (11.6)	0.0740
Infused fluid during insertion, mL	83 (200)	1702 (587)	1708 (840)	1644 (612)	<0.0001
Aspirated fluid during insertion, mL	183 (153)	1643 (583)	1641 (710)	1552 (564)	<0.0001

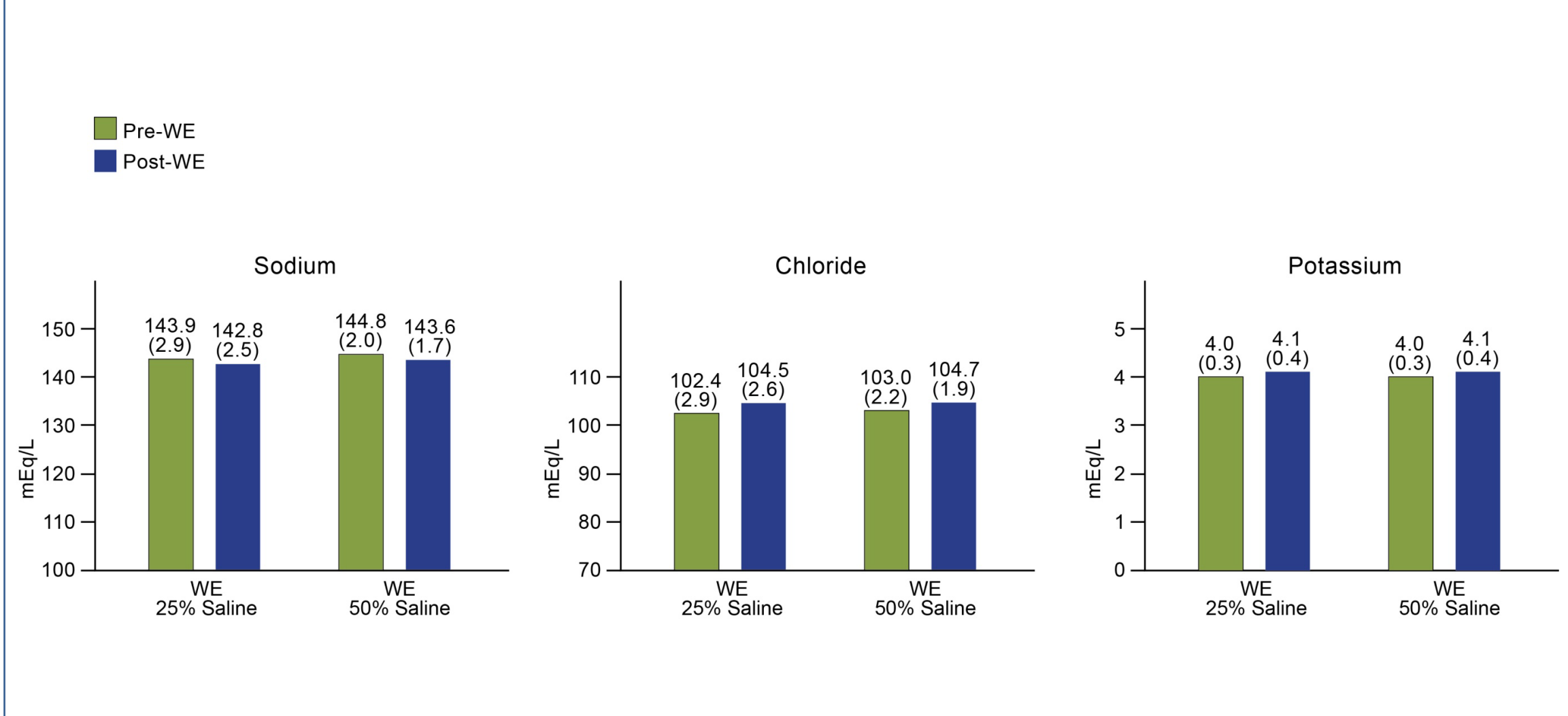
Colonoscopy Detection Data

	CO ₂ (N=70)	WE water (N=75)	WE 25% saline (N=75)	WE 50% saline (N=76)	Overall P value
Overall ADR, n (%)	35 (50.0)	31 (41.3)	35 (46.7)	41 (53.9)	0.4674
Overall APC (SD)	1.1 (1.7)	1.0 (2.4)	0.8 (1.2)	1.0 (1.7)	0.4608
CSSP detection rate, n (%)	12 (17.1)	10 (13.3)	10 (13.3)	9 (11.8)	0.8467
CSSP per colonoscopy (SD)	0.3 (0.9)	0.1 (0.4)	0.2 (0.5)	0.4 (1.8)	0.8268

Predictor of Moderate Mucus Production with WE

Patients with a LCMS score ≥ 2	Univariate		Multivariate	
Variable	OR (95% CI)	P value	OR (95% CI)	P value
Female (male reference)	1.008 (0.558-2.120)	0.8040		
BMI (for a 1-kg/m ² increment)	0.966 (0.880-1.060)	0.4655		
Previous abdominal surgery	1.251 (0.626-2.497)	0.5262		
Difficult colonoscopy	2.374 (1.113-5.062)	0.0253	1.506 (0.495-4.586)	0.4709
Infused fluid volume during insertion (for a 100-mL increment)	1.095 (1.050-1.141)	<0.0001	1.048 (0.973-1.129)	0.2190
WE water group (WE 50% saline as reference)	27.55 (6.29-120.62)	<0.0001	33.27 (7.23-153.19)	<0.0001

Mean Serum Electrolyte Levels Before and After WE-Saline Infusion



Discussion

- IN THIS RANDOMIZED STUDY, WE FOUND THAT **WATER** FILLING DURING WATER EXCHANGE COLONOSCOPY IS THE SOLE PREDICTOR OF **INCREASED MUCUS** PRODUCTION IN LEFT COLON. USE OF **HALF SALINE** SIGNIFICANTLY **INHIBITS MUCUS** PRODUCTION.
- THE PRESENCE OF MUCUS PRODUCES FALSE POSITIVES IN COMPUTER-AIDED COLONOSCOPY. MUCUS REDUCTION BY **SALINE** OPENS UP A NEW AVENUE FOR RESEARCH IN ITS COMPLEMENTARY ROLE WHEN INCORPORATING **ARTIFICIAL INTELLIGENCE** AND **WATER EXCHANGE**.