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Comparison of Single-Dose and Split-Dose Fecal Tagging With Iohexol in Computed Tomographic Colonography

Andrey I. Meshcheryakov¹, Nadezhda Yu. Gurova¹, Olga G. Pugacheva¹, Alina V. Yakovleva¹, Irina N. Kieva², Ekaterina A. Kurmyshova³

¹ Polyclinic No. 3 General Management Department for the President of Russian Federation, Moscow, Russia;

² P.A. Herten Moscow Research Institute of Oncology, National Medical Research Radiological Center, Moscow, Russia;

³ Central State Medical Academy of the Presidential Executive Office of the Russian Federation, Moscow, Russia

ABSTRACT

BACKGROUND: Proper fecal tagging allows for high-quality computed tomography colonography. However, there is no single tagging scheme. Therefore, the effects of a contrast enhancement regimen on fecal tagging should be evaluated.

AIM: This study aimed to compare the quality of single-dose fecal tagging with that of split-dose fecal tagging with iohexol during computed tomographic colonography and to assess the impact of these regimens on procedure tolerability.

METHODS: In this retrospective, selective, single-center study, the patients were divided into two groups based on whether they received single-dose (group 1) or split-dose (group 2) fecal tagging. Both groups received 50 mL of the iodine-containing contrast agent iohexol, with iodine concentration of 350 mg/mL. The residual liquid density was assessed using three parameters: maximum, minimum, and mean values. Additionally, the residual fluid homogeneity was assessed by calculating the mean standard deviation within the region of interest. Tolerability of preparation for colonography was assessed using a 10-point visual analog scale.

RESULTS: The final sample included 338 patients: 116 in group 1 and 222 in group 2. The mean, minimum, and maximum density values in group 2 were significantly higher than those in group 1: 943 [722; 1245], 753 [525; 1082], and 1079 HU [801; 1456] versus 681 [420; 907], 570 [374; 820], and 825 HU [496; 1154], respectively ($p < 0.001$). The residual fluid homogeneity was significantly higher in group 2 than in group 1: 59 [46; 78] versus 67 HU [54; 81] ($p = 0.012$). Group 2 showed a significantly lower subjective difficulty of preparation than did group 1: 4 [2; 6] and 5 [4; 7], respectively ($p = 0.004$).

CONCLUSION: A single dose of 50 mL of iohexol (iodine concentration: 350 mg/mL) provides higher-quality fecal tagging than a split-dose provides because of higher residual fluid density with maintained homogeneity. Moreover, single-dose tagging was found to be more tolerable.

Keywords: computed tomography colonography; computed tomography; iohexol; colorectal cancer.

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Сравнение качества одноэтапной и двухэтапной маркировки остаточного кишечного содержимого йогексолом при компьютерной томографической колонографии

А.И. Мещеряков¹, Н.Ю. Гурова¹, О.Г. Пугачёва¹, А.В. Яковлева¹, И.Н. Киева², Е.А. Курмышова³¹ Поликлиника № 3 Управления делами Президента Российской Федерации, Москва, Россия;² Московский научно-исследовательский онкологический институт имени П.А. Герцена — филиал Национального медицинского исследовательского центра радиологии, Москва, Россия;³ Центральная государственная медицинская академия Управления делами Президента Российской Федерации, Москва, Россия

АННОТАЦИЯ

Обоснование. Маркировка остаточного кишечного содержимого играет решающую роль в обеспечении высокого качества компьютерной томографической колонографии. Однако не существует единой схемы его маркировки. В связи с этим целесообразно изучить влияние схемы приёма контрастного препарата на качество маркировки остаточного кишечного содержимого.

Цель исследования. Сравнение качества одноэтапной и двухэтапной маркировки остаточного кишечного содержимого йогексолом при компьютерной томографической колонографии и оценка их влияния на переносимость подготовки у пациентов.

Методы. Проведено ретроспективное выборочное одноцентровое исследование. Сформировано две группы пациентов: с двухэтапной (1-я группа) и одноэтапной (2-я группа) маркировкой остаточного кишечного содержимого. В обеих группах применяли йодсодержащий контрастный препарат йогексол в дозе 50 мл (концентрация йода 350 мг/мл). Оценку плотности остаточной жидкости проводили по трём показателям: максимальному, минимальному и среднему значению. Гомогенность резидуальной жидкости определяли как среднее арифметическое значение стандартного отклонения в области интереса. Переносимость подготовки оценивали по 10-балльной визуально-аналоговой шкале.

Результаты. В итоговую выборку включили 338 пациентов: 1-я группа ($n=116$); 2-я группа ($n=222$). Значения средней, минимальной и максимальной плотности во 2-й группе были статически значимо выше, чем в 1-й группе: 943 [722; 1245], 753 [525; 1082] и 1079 HU [801; 1456] против 681 [420; 907], 570 [374; 820] и 825 HU [496; 1154] соответственно, $p < 0,001$. Остаточная жидкость во 2-й группе была статически значимо более гомогенная, чем в 1-й группе: 59 [46; 78] против 67 HU [54; 81], $p=0,012$. Субъективное ощущение тяжести подготовки было статически значимо меньше во 2-й группе по сравнению с 1-й группой: 4 [2; 6] и 5 баллов [4; 7] соответственно ($p=0,004$).

Заключение. Однократный приём йогексола в дозе 50 мл (концентрация йода 350 мг/мл) обеспечивает более высокое качество маркировки остаточного кишечного содержимого и жидкости по сравнению с его двукратным приёмом, что обусловлено повышением плотностных характеристик остаточной жидкости при сохранении её гомогенности. Кроме того, одноэтапная маркировка характеризуется лучшей переносимостью пациентами.

Ключевые слова: компьютерная томографическая колонография; компьютерная томография; йогексол; колоректальный рак.

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单阶段与双阶段碘海醇肠腔残余物标记质量的比较：基于计算机断层结肠成像的研究

Andrey I. Meshcheryakov¹, Nadezhda Yu. Gurova¹, Olga G. Pugacheva¹, Alina V. Yakovleva¹,
Irina N. Kieva², Ekaterina A. Kurmyshova³

¹ Polyclinic No. 3 General Management Department for the President of Russian Federation, Moscow, Russia;

² P.A. Herten Moscow Research Institute of Oncology, National Medical Research Radiological Center, Moscow, Russia;

³ Central State Medical Academy of the Presidential Executive Office of the Russian Federation, Moscow, Russia

摘要

论证： 肠腔残余物的标记在确保计算机断层结肠成像的高质量中起关键作用。然而，目前尚无统一的标记方案。因此，有必要研究对比剂服用方案对残余物标记质量的影响。

目的： 比较单阶段与双阶段碘海醇肠腔残余物标记在计算机断层结肠成像中的质量，并评估其对患者准备耐受性的影响。

方法： 本研究为单中心回顾性抽样研究。根据肠腔残余物标记方案将患者分为两组：双阶段标记组（第1组）与单阶段标记组（第2组）。两组均应用碘造影剂碘海醇，剂量为50 ml（碘浓度350 mg/ml）。残余液体密度采用最大值、最小值及平均值进行评估。均匀性通过感兴趣区内标准差的算术平均值计算。准备耐受性采用10分视觉模拟量表评分。

结果： 最终纳入338例患者：第1组（ $n=116$ ），第2组（ $n=222$ ）。第2组残余液体的平均、最小和最大密度显著高于第1组：943 [722; 1245]、753 [525; 1082]和1079 HU [801; 1456]，对比681 [420; 907]、570 [374; 820] 和825 HU [496; 1154]，分别， $p<0.001$ 。第2组残余液体均匀性也显著优于第1组：59 [46; 78] 对比67 HU [54; 81]， $p=0.012$ 。患者对准备过程的主观负担在第2组显著低于第1组：4 [2; 6] 分和5 [4; 7] 分，分别（ $p=0.004$ ）。

结论： 单次服用50 ml碘海醇（碘浓度350 mg/ml）相比两次服用，可显著提高残余物及残余液体的标记质量，这与残余液体密度特征的增加及其均匀性的保持有关。此外，单阶段标记具有更好的患者耐受性。

关键词： 计算机断层结肠成像；计算机断层扫描；碘海醇；结直肠癌。

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BACKGROUND

Proper fecal tagging is crucial for effective computed tomography colonography (CT colonography) [1, 2]. Previous research shows that fecal tagging substantially increases the detection rate of colorectal neoplasms measuring 6 mm or larger on CT colonography [3]. Along with laxatives and a low-residue diet, tagging is an essential part of preparing for CT colonography [2, 4]. Proper tagging is also required for electronic cleansing algorithms that digitally subtract tagged contents from the large intestine lumen to enable continuous endoluminal 3D imaging [5].

Water-soluble iodinated contrast agents are superior to barium sulfate agents for achieving homogeneous tagging and do not affect the quality of same-day colonoscopies [6]. Consequently, iodinated contrast agents such as meglumine diatrizoate, sodium diatrizoate, and iohexol are the most commonly used for fecal tagging worldwide [1]. Non-ionic iohexol has several advantages over ionic meglumine diatrizoate. Iohexol is safer, more palatable, and more affordable in many countries [7]. In contrast, diatrizoate has an unpleasant taste and can cause nausea, abdominal cramps, and diarrhea because of its high osmolality [8]. Furthermore, iohexol has been reported to provide superficial contrast coating of the polyp mucosa, improving the sensitivity of CT colonography in the detection of flat polyps [9].

Despite the numerous techniques for fecal tagging, there is no single strategy [10]. Some authors recommend single-dose tagging [4, 7, 8, 11], while others prefer a split-dose procedure [10–13]. However, there are no standardized criteria for tagging quality. The optimal residual fluid attenuation is generally considered to be above 400–500 Hounsfield units (HU) [7, 14], and the minimum acceptable level is 200 HU [14]. Current electronic cleansing algorithms operate at residual fluid attenuation level of greater than 250 HU [15]. Tagging homogeneity and fluid volume are also used as quality criteria when preparing for colonoscopy [4]. Therefore, it is relevant to assess the impact of the contrast regimen on tagging quality. This means to evaluate the minimum, maximum, and mean residual fluid attenuation; compare these levels with CT colonography benchmarks and electronic cleansing thresholds; and assess fluid homogeneity and volume. Furthermore, the impact of tagging regimens on preparation tolerability should be evaluated. Bellini et al. [16] consider the preparation stage to be the most burdensome for patients.

Our clinic successively used two fecal tagging regimens, both of which involved 50 mL of iohexol, an iodinated contrast agent with a concentration of 350 mg I/mL. The first split-dose regimen was used until September 2020. Then, we switched to the second single-dose regimen.

AIM

To compare the quality of single-dose and split-dose fecal tagging with iohexol in CT colonography, as well as to assess the impact of these regimens on preparation tolerability.

METHODS

Study Design

This was a retrospective, sample-based, single-center study.

Study Setting

The study included patients who underwent CT colonography at Outpatient Clinic No. 3 of the Presidential Executive Office of the Russian Federation from August 2017 to May 2023.

Eligibility Criteria

Inclusion criteria:

- Full preparation for colonoscopy, including diet, laxatives, and fecal tagging;
- A completed questionnaire.

Non-inclusion criteria: History of surgery for colorectal cancer.

Study Duration

The study period was from August 2017 to June 2024.

Group Analysis

The study included two groups:

- Group 1: CT colonography with split-dose iohexol tagging in a clinical setting from August 2017 to September 2020;
- Group 2: CT colonography with switch to single-dose tagging in a clinical setting from September 2020 to May 2023.

Computed Tomography Colonography

Preparation for computed tomography colonography

Preparation included:

- diet,
- laxatives, and
- fecal tagging.

Both groups received 50 mL of oral iohexol (350 mg I/mL) for fecal tagging. For split-dose tagging, 500 mL of water was used to dilute iohexol. Patients took half of the resulting solution at 17:00 the day before the procedure, after beginning preparation with a laxative. The other half of the solution was taken at 21:00–22:00, after completing preparation with a laxative. For single-dose tagging, 250 mL of water were used to dilute iohexol. Patients took the entire volume of the resulting solution at 21:00–22:00 the day before the procedure, after preparation with a laxative.

The preparation was otherwise the same for both groups and included a low-residue diet and the use of a laxative (2 L of polyethylene glycol combined with ascorbic acid) the night before the procedure. Patients were instructed to avoid solid food on the day of the procedure. All patients underwent CT colonography at 08:00–11:00 on the day following completion of preparation. Antispasmodics were not used for preparation.

Computed tomography colonography procedure

All CT colonographies were performed according to the consensus guidelines of the European Society of Gastrointestinal and Abdominal Radiology (ESGAR) [2]. Prior to CT scans, patients were instructed to empty their bowels until no solid or loose stool remained. The large intestine lumen was inflated using manual room air insufflation. Scans were performed in two positions: supine and prone. If adequate colon distension was not achieved in these two positions, an additional scan was performed in the lateral decubitus position after further air insufflation.

Equipment

CT colonography was performed using the same low-dose scanning parameters on two scanners: GE Lightspeed® 16 and GE Lightspeed® VCT 64 (both from GE Healthcare, USA). The settings were 120 kV (140 kV for overweight patients) and 50–75 mAs with current modulation along the Z-axis. Detector collimation was 64 mm × 0.625 mm, tube rotation time was 0.6 s, pitch was 1.375, and reconstructed section thickness was 1.25 mm. Patients were randomly assigned to CT scanners depending on the workload of each apparatus. The images were reconstructed using the Adaptive Statistical Iterative Reconstruction (ASiR®) algorithm (GE Healthcare, USA).

Main Study Outcome

Comparison of single-dose and split-dose fecal tagging with iohexol in CT colonography.

Additional Study Outcome

Comparison of the tolerability of preparation for CT colonography using different fecal tagging regimens.

Outcomes Registration

Evaluation of computed tomography colonography images and tagging quality

A combination of parameters was used to evaluate the quality of fecal tagging:

- Residual fluid attenuation;
- Residual fluid homogeneity;
- Percentage of scans with mean residual fluid attenuation of less than 250 HU (the lowest threshold for using electronic cleansing algorithms);
- Mean residual fluid attenuation of <400 HU (the lowest optimal level);
- Residual content volumes in six large intestine segments (rectum, sigmoid, descending, transverse, and ascending colon, and cecum).

Anonymized images were transferred for evaluation on the Advantage Workstation® 4.5 (GE Healthcare, USA) with specialized software for processing CT colonography scans (Colon VCAR®, GE Healthcare, USA). Two radiologists, one with two years of experience and the other with 11 years of experience, interpreted the images. Residual fluid attenuation

was assessed using maximum, minimum, and mean levels, which were calculated as arithmetic means of measurements across the three most representative segments of the large intestine. The regions of interest for attenuation measurements were adjusted to include as much of the tagged fluid as possible while excluding other structures [8]. A previously developed method was used to quantitatively assess residual fluid homogeneity, calculating it as the arithmetic mean of the standard deviation in the three most representative segments of the region of interest [17]. Residual content volumes in six large intestine segments (rectum, sigmoid, descending, transverse, and ascending colon, and cecum) were assessed using a previously developed four-point visual analogue scale (VAS): 4, no fluid or stool; 1, maximum residual content; 2–3, intermediate values [18]. Then, the total residual content score was calculated by summing the scores for each segment of the large intestine. Two-dimensional images were used for the visual assessment. The recommended window settings for CT colonography included a width of 2000 HU and a level of 0 HU.

Perceived difficulty of preparation for computed tomography colonography

The impact of switching tagging regimens on perceived difficulty of preparation was additionally evaluated. A standard questionnaire with a 10-point VAS was used to evaluate perceived difficulty of preparation before CT colonography. The questionnaire also asked about potential adverse effects of the preparation, such as nausea, vomiting, abdominal pain, weakness, dizziness, and sleep disturbances. Two additional parameters were evaluated: number of stools and willingness to repeat the procedure. Patients with a history of colonoscopy were asked to specify which preparation was easier: for CT colonography, for colonoscopy, or no difference.

Ethics Approval

The study was approved by the local Ethics Committee of Outpatient Clinic No. 3 (Minutes No. 1-06-2017 of June 29, 2017).

Statistical Analysis

Sample size calculation: The Lehr formula was used to calculate the required sample size (with a power of 80%).

Statistical methods: After normality testing, we compared the groups using the Mann–Whitney *U* test for quantitative variables and the Pearson's chi-squared test for categorical variables. The quantitative data are presented as Me [Q1; Q3], where Me is the median, Q1 is the first quartile, and Q3 is the third quartile. The qualitative data are presented as absolute and relative values. Differences were considered significant at $p < 0.05$. The Cohen's kappa coefficient was used to assess inter-rater agreement. The agreement was considered satisfactory or good if κ was 0.40–0.75, and excellent if κ was >0.75 . Jamovi® v.2.3.28 (The Jamovi Project, Australia) was used to perform all calculations.

RESULTS

Sampling

Figure 1 shows the sampling sequence in the study.

Sample Characteristics

The final sample included 338 patients: 137 men (40.5%) and 201 women (59.5%). The median age was 73 [60; 80] years. Group 1 included patients who underwent split-dose fecal tagging ($n = 116$), and group 2 included patients who

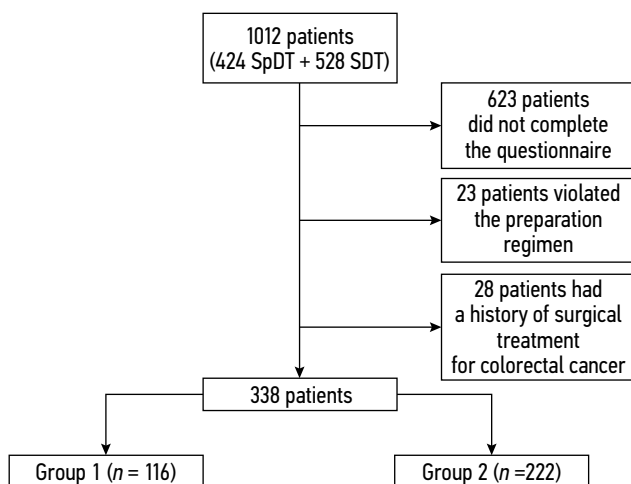


Fig. 1. Sampling sequence in the study. CRC, colorectal cancer; SDT, single-dose tagging; SpDT, split-dose tagging.

underwent single-dose fecal tagging ($n = 222$) (see Fig. 1). The pooled study sample had a total of 38 polyps measuring 6–9 mm, 13 polyps measuring ≥ 10 mm, and 4 cases of colorectal cancer. There were no significant intergroup differences in detection rates of colorectal neoplasms ($p > 0.05$). The polyp detection rate was 15%. Diverticular disease was reported in 241 patients (71.3%), with 161 having multiple diverticula (47.6%) (see Table 1).

Primary Results

Table 2 shows quality assessment results for fecal tagging. The mean, minimum, and maximum residual fluid attenuation levels in group 2 were all significantly higher than in group 1 ($p < 0.001$; see Table 2). Figure 2 shows box plots of fecal tagging quality parameters depending on the tagging regimen. The residual fluid in group 2 was significantly more homogeneous than in group 2 ($p = 0.012$; see Table 2). Figure 3 shows a box plot of homogeneity parameters depending on the tagging regimen. The mean attenuation level of ≤ 400 HU was observed significantly less frequently in group 2 than in group 1 ($p < 0.001$; see Fig. 4). Good inter-rater agreement was demonstrated in assessing residual fluid attenuation parameters ($\kappa = 0.72$; 95% confidence interval, 0.67–0.76).

Secondary Results

The perceived difficulty of preparation, as measured by 10-point VAS scores, was significantly lower in group 2 than in group 1 ($p = 0.004$; see Fig. 5). There were

Table 1. Key characteristics of patients and changes across groups

Characteristics	Group 1, $n = 116$	Group 2, $n = 222$	p -value
Age, years	75 [68; 80]	71 [55; 80]	0.003*
Male-to-female ratio, n	38/78	99/123	0.035
Polyps: 6–9 mm, n (%)	15 (12.9)	23 (10.4)	>0.05
Polyps: ≥ 10 mm, n (%)	7 (6)	6 (2.7)	>0.05
Colorectal cancer, n (%)	1 (0.9)	3 (1.4)	>0.05
Diverticular disease, n (%)	96 (82.8)	145 (65.3)	<0.001*
Multiple diverticula, n (%)	71 (61.2)	90 (40.5)	<0.001*

Note. The quantitative data are presented as Me [Q1; Q3], where Me is the median, Q1 is the first quartile, and Q3 is the third quartile. The Mann–Whitney U test was used to compare quantitative data and the Pearson's chi-squared test was used to compare qualitative data. * Differences are significant.

Table 2. Fecal tagging quality across groups

Parameters	Group 1, $n = 116$	Group 2, $n = 222$	p -value
Mean attenuation, HU	681 [420; 907]	943 [722; 1245]	<0.001*
Maximum attenuation, HU	825 [496; 1154]	1079 [801; 1456]	<0.001*
Minimum attenuation, HU	570 [347; 820]	753 [525; 1082]	<0.001*
Homogeneity, HU	67 [54; 81]	59 [46; 78]	0.012
Mean attenuation: <250 HU, n (%)	9 (7.8)	0 (0)	<0.001*
Mean attenuation: ≤ 400 HU, n (%)	24 (20.7)	5 (2.3)	<0.001*

Note. The quantitative data are presented as Me [Q1; Q3], where Me is the median, Q1 is the first quartile, and Q3 is the third quartile. The Mann–Whitney U test was used to compare quantitative data and the Pearson's chi-squared test was used to compare qualitative data. * Differences are significant.

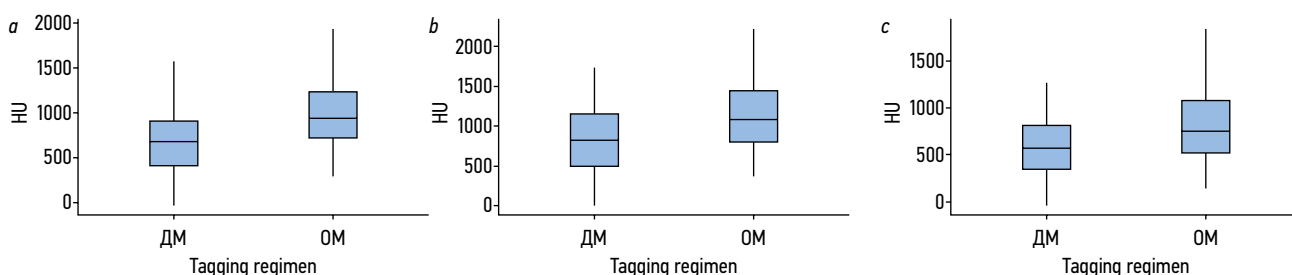


Fig. 2. Box plots of fecal tagging quality parameters: *a*, mean residual fluid attenuation; *b*, maximum residual fluid attenuation; *c*, minimum residual fluid attenuation. SDT, single-dose tagging; SpDT, split-dose tagging.

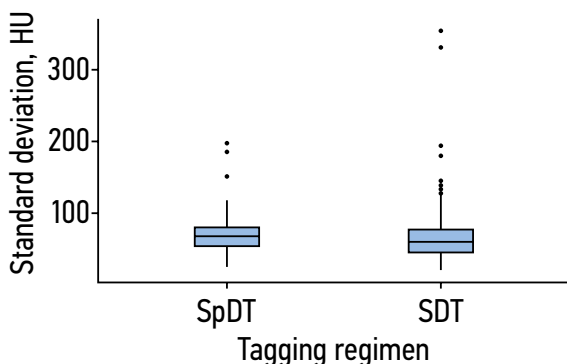


Fig. 3. Box plot of residual fluid homogeneity parameters (standard deviation in Hounsfield units in the region of interest). SDT, single-dose tagging; SpDT, split-dose tagging.

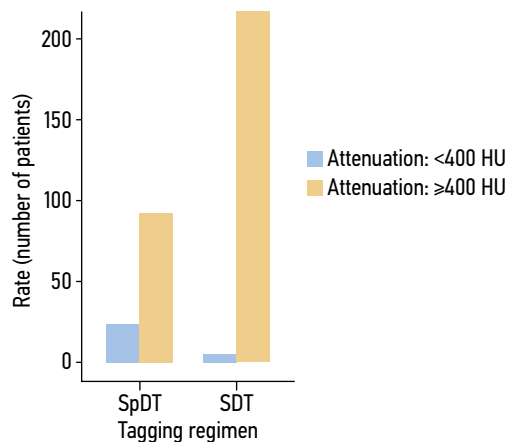


Fig. 4. Bar charts of residual fluid attenuation frequencies of <400 HU and >400 HU. SDT, single-dose tagging; SpDT, split-dose tagging.

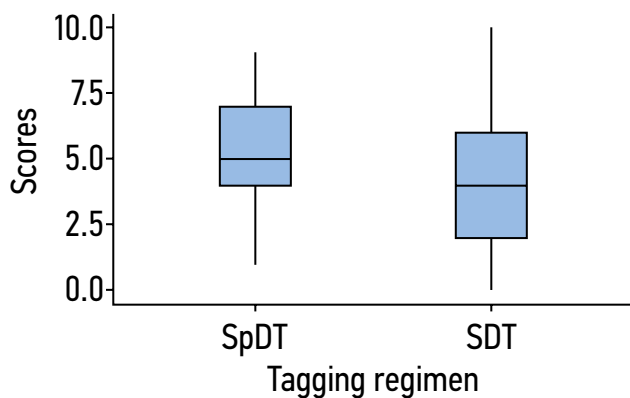


Fig. 5. Box plot of visual analogue scale scores for perceived difficulty in preparation. SDT, single-dose tagging; SpDT, split-dose tagging.

no significant differences in the number of stools or in willingness to repeat the procedure. Furthermore, there were no significant intergroup differences in the incidence of abdominal pain, nausea, vomiting, weakness, dizziness, or bloating during preparation for CT colonography (see Table 3).

DISCUSSION

Summary of Primary Results

Our retrospective study showed that single-dose fecal tagging was superior to split-dose tagging. The key advantages of single-dose tagging were improved residual

Table 3. Tolerability of preparation for computed tomographic colonography across groups

Parameters	Group 1, n = 116	Group 2, n = 222	p-value
Perceived difficulty in preparation, scores	5 [4; 7]	4 [2; 6]	0.004*
Willingness to repeat the procedure, n (%)	85 (73.3%)	181 (81.5)	>0.05
Abdominal pain, n (%)	24 (20.7)	61 (27.5)	>0.05
Nausea and vomiting, n (%)	17 (14.7)	36 (16.2)	>0.05
Weakness or dizziness, n (%)	17 (14.7)	48 (21.6)	>0.05
Bloating, n (%)	37 (31.9)	71 (32.3)	>0.05

Note. The quantitative data are presented as Me [Q1; Q3], where Me is the median, Q1 is the first quartile, and Q3 is the third quartile. * Differences are significant.

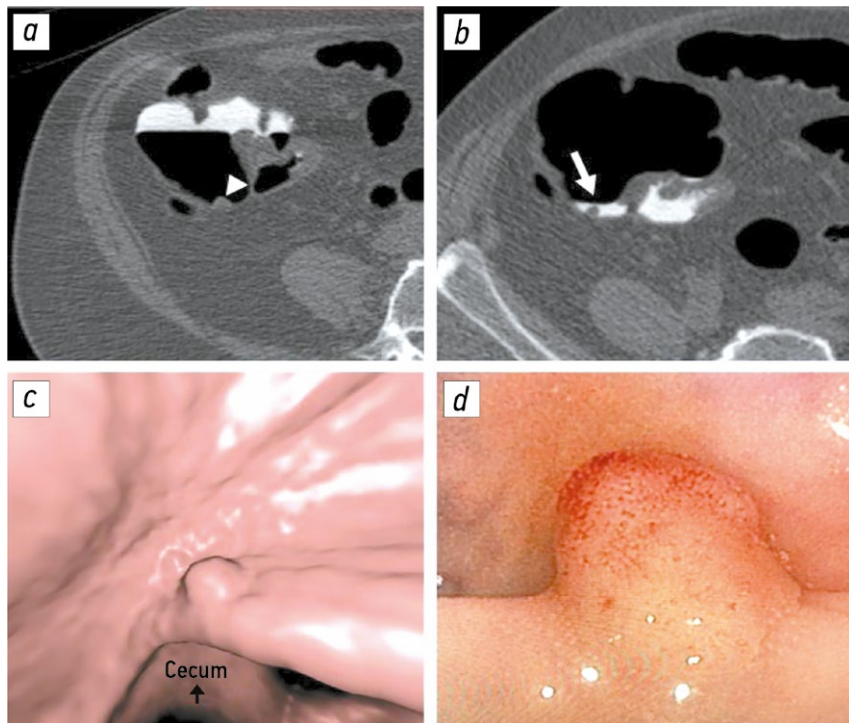


Fig. 6. Representative computed tomography colonography image with single-dose fecal tagging using 50 mL of iohexol (350 mg I/mL). Mean residual fluid attenuation in the large intestine was 1228 HU. *a*, the axial image in the prone position shows an 8-mm ascending colon polyp (arrowhead) near the ileocecal valve; *b*, in the prone position, the polyp is submerged under a layer of tagged residual fluid (arrow) but remains clearly visible; *c*, 3D endoluminal reconstruction: the black arrow indicates the virtual endoscope's trajectory toward the cecum; *d*, the polyp was confirmed by colonoscopy followed by same-day polypectomy (histology: adenoma).

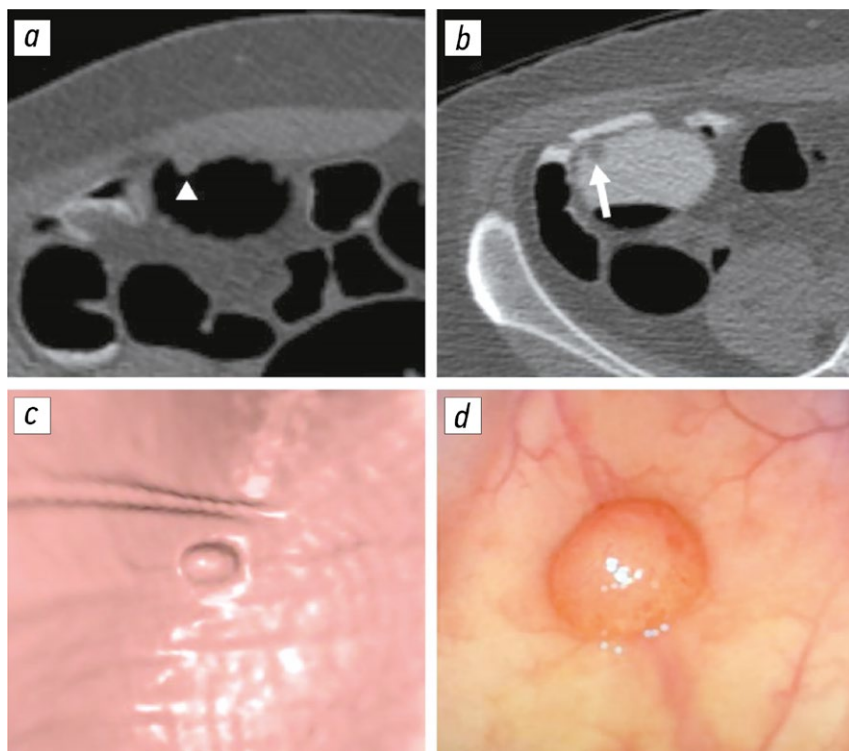


Fig. 7. Representative computed tomography colonography image with split-dose fecal tagging using 50 mL of iohexol (350 mg I/mL). Mean residual fluid attenuation in the large intestine was 496 HU. *a*, the axial image in the supine position shows a 6-mm cecum polyp (arrowhead); *b*, in the prone position, the polyp is submerged under a layer of tagged residual fluid (arrow); the low attenuation of the residual fluid makes the polyp difficult to visualize; *c*, 3D endoluminal reconstruction; *d*, the polyp was confirmed by colonoscopy followed by same-day polypectomy (histology: adenoma).

fluid attenuation and significant decrease in the number of scans with suboptimal attenuation (400 HU) (see Figs. 6, 7). None of the patients in group 2 had residual fluid attenuation below 250 HU, which enabled the use of electronic cleansing algorithms in all cases. Another advantage was that group 2 reported a lower perceived level of difficulty in preparation, as measured by VAS scores.

Switching from a split-dose to a single-dose tagging regimen did not affect residual content homogeneity or volume. There were no significant differences in the incidence of adverse effects.

Discussion of Primary Results

Although switching from a split-dose to a single-dose tagging regimen improved the perceived difficulty of preparation, there were no significant intergroup differences in willingness to repeat the procedure. This may be caused by insufficient sample size because this parameter was not the primary result of the study. However, switching to a different tagging regimen improved the overall tolerability of preparation and increased screening coverage [19].

Unlike other studies, which used a larger contrast dose for tagging, our study used only 50 mL of iohexol [10, 12]. For example, Wilson et al. [10] performed tagging with 50:50 and 75:25 ratios of meglumine diatrizoate 24 and 12 hours before the procedure, respectively. Nagata et al. [12] performed CT colonography using iohexol (300 mg/mL) administered in seven 10-mL doses with meals over 48 hours before the procedure, without dietary restrictions. Three hours before the procedure, patients received additional 30 mL of non-ionic iodinated contrast agent diluted in 700 mL of water. Only Utano et al. [13] used a comparable volume of contrast agent (20 mL of sodium diatrizoate after an evening meal) for split-dose tagging. Patients received the second dose of the contrast agent (20 mL of sodium diatrizoate) in the morning on the day of the procedure, which increased the risk of incomplete tagging of the left large intestine because optimal tagging time is at least 4.0–4.5 hours [14, 20].

Study Limitations

Our study has several limitations. First, this was a retrospective study. Second, performance of electronic cleansing algorithms for each tagging regimen was not evaluated directly. However, a threshold exceeding 250 HU reliably indicates the performance of these algorithms because it aligns with the manufacturer's technical

specifications [15]. Third, we measured residual fluid attenuation in the three most representative large intestine segments, regardless of their anatomical structure. However, this measurement method is not expected to significantly impact the final results, because two experienced radiologists independently achieved good agreement on attenuation measurements. Finally, we did not evaluate the immediate impact of the proposed tagging regimen on diagnostic accuracy. However, the accuracy of colonography depends on the quality of preparation, so it can be assumed that adequate preparation should not reduce its accuracy.

CONCLUSION

A single dose of iohexol (350 mg I/mL) resulted in better fecal tagging than a split-dose regimen. It increased attenuation levels without compromising homogeneity. Patients tolerated the single-dose regimen better than the split-dose regimen. Therefore, our findings are relevant to clinical practice because improved tagging quality makes CT colonography scans easier to interpret and ensures more reliable performance of electronic cleansing algorithms. Improved tolerability of single-dose tagging could provide greater screening coverage for colorectal cancer.

ADDITIONAL INFORMATION

Author contributions: A.I. Meshcheryakov: conceptualization, methodology, investigation, writing—original draft, writing—review & editing, visualization, formal analysis; N.Yu. Gurova, O.G. Pugacheva: conceptualization, methodology, writing—original draft, writing—review & editing; I.N. Kieva, A.V. Yakovleva, E.A. Kurmyshova: investigation, formal analysis. All the authors approved the version of the manuscript to be published and agreed to be accountable for all aspects of the work, ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved.

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AUTHORS' INFO

* **Andrey I. Meshcheryakov**, MD;

address: 14 Dubninskaya st, unit 1, Moscow, Russia, 127540;

ORCID: 0000-0002-6609-0614;

eLibrary SPIN: 6119-7999;

e-mail: aim.radiologist@gmail.com

Nadezhda Yu. Gurova, MD, Cand. Sci. (Medicine);

ORCID: 0000-0003-1351-4193;

eLibrary SPIN: 1612-0855;

e-mail: gurova@pudp.ru

Olga G. Pugacheva, MD;

ORCID: 0000-0001-9297-3341;

eLibrary SPIN: 4942-8093;

e-mail: pugachovaolga@yandex.ru

Alina V. Yakovleva, MD;

ORCID: 0009-0008-2257-1513;

eLibrary SPIN: 8938-4323;

e-mail: samolina@yandex.ru

Irina N. Kievna, MD;

ORCID: 0000-0002-4060-5966;

eLibrary SPIN: 2279-9141;

e-mail: miamodiaz@gmail.com

Ekaterina A. Kurmyshova, MD;

ORCID: 0009-0008-5852-2932;

e-mail: kurmyshca@gmail.com

ОБ АВТОРАХ

* **Мещеряков Андрей Иванович**;

адрес: Россия, 127540, Москва, ул. Дубинская, д. 14, к. 1;

ORCID: 0000-0002-6609-0614;

eLibrary SPIN: 6119-7999;

e-mail: aim.radiologist@gmail.com

Гурова Надежда Юрьевна, канд. мед. наук;

ORCID: 0000-0003-1351-4193;

eLibrary SPIN: 1612-0855;

e-mail: gurova@pudp.ru

Пугачёва Ольга Геннадьевна;

ORCID: 0000-0001-9297-3341;

eLibrary SPIN: 4942-8093;

e-mail: pugachovaolga@yandex.ru

Яковлева Алина Викторовна;

ORCID: 0009-0008-2257-1513;

eLibrary SPIN: 8938-4323;

e-mail: samolina@yandex.ru

Киевна Ирина Николаевна;

ORCID: 0000-0002-4060-5966;

eLibrary SPIN: 2279-9141;

e-mail: miamodiaz@gmail.com

Курмышова Екатерина Андреевна;

ORCID: 0009-0008-5852-2932;

e-mail: kurmyshca@gmail.com

* Corresponding author / Автор, ответственный за переписку