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The effect of adhesiolysis on stoma takedown in patients with end colostomy

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ABSTRACT *AIM: the optimal extent of adhesiolysis for stoma takedown after Hartmann's procedure is still unknown. This study is for evaluation the early and late results after partial and total dissection of adhesions during Hartmann's reversal (HR).*
PATIENTS AND METHODS: a prospective non-randomized study included 99 patients with end colostomy. Fifty patients were included in the main group, in which partial adhesiolysis was performed during HR, and 49 — were the control group, in which complete dissection of adhesions was performed. The groups did not differ in the basic demographic characteristics, number of previous operations, and the severity of the adhesions.
RESULTS: the operation time in the groups of partial and total adhesiolysis was 222 vs 205 minutes, respectively (p = 0.9). Injury of the intestinal wall occurred in 18 patients in the main group, and in 19 controls (p = 0.8). The postoperative stay was 12 in the main group vs 11 in the control (p = 0.7). The morbidity rate in the main group was 42% (n = 21), in controls — 29% (n = 14) (p = 0.2). Reoperations were performed in 4 patients of the main group, no reoperations in the control group were required, but no significant differences were obtained (p = 0.5). In the group of partial adhesiolysis, 1 fatal outcome was registered. By the regression analysis, the only factor increasing the likelihood of postoperative complications was a BMI > 35 kg/m2 (OR = 5.3; 95% CI: 1.5–21.2; p = 0.01).
CONCLUSION: total adhesiolysis does not affect the operation time and traumatism of Hartmann reversal, does not increase morbidity rate.

KEYWORDS: *adhesiolysis, partial adhesiolysis, total adhesiolysis, colostomy closure, Hartmann operation, adhesive process, adhesions*

CONFLICT OF INTEREST: *the authors declare that there is no conflict of interest*

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INTRODUCTION

Currently, Hartmann's procedure remains relevant for various coloproctological diseases. According to literature data, the most common causes of the end colostomy after colorectal resection today are the complicated diverticular disease, which accounts for up to 80% of all cases [1], and tumor obstruction in rectal cancer — in 10% of cases [2]. Stoma affects quality of life and encourages patients to seek further surgical rehabilitation. Stoma takedown remains one of the most difficult in practice and are accompanied by a high postoperative morbidity rate, which reaches 30% [3–5]. The main technical difficulties in stoma takedown, according to the literature, are due to the peritoneal adhesions, the short stump of the disconnected intestine, as well as chronic inflammatory changes in the pelvic organs [4,6,7]. At the same time, the need to separate peritoneal adhesions occurs in almost every patient during re-operations [8,9] and may be associated with an additional postoperative complication risk [10–12]. The available data do not allow us to speak unequivocally about what volume of adhesion in Hartmann's reversal (HR) should be considered

optimal [13,14]? In modern literary sources on this issue, there are only expert opinions that are ambiguous: some consider partial dissection of adhesions sufficient [15–19], others prefer to perform complete adhesiolysis [18,20]. In this regard, a study was done at the RNMRC of Coloproctology aimed to clarify optimal volume of adhesiolysis for HR in patients with end colostomy.

AIM

The aim of the study was to improve the results of stoma takedown surgery in patients who had previously undergone Hartmann's procedure.

PATIENTS AND METHODS

A single-center, prospective study included adult patients with end colostomy after Hartmann's procedure, who were scheduled for stoma takedown, who signed an informed voluntary consent to participate. The non-inclusion criterion was an assessment of the somatic status of over ASA 3. The exclusion criteria were refusal to participate in the study, refusal to create the anastomosis, as well as the stage of the adhesive process L3 according to the peritoneal adhesion index (PAI) [21], in which injury to the intestinal wall could inevitably be expected during adhesiolysis. The selection of patients for the study took place between November 2021 and September 2023. Patients were randomly assigned to the main group (n = 50), where partial adhesiolysis was performed, and to the control group (n = 49), in which complete adhesiolysis was performed. With partial adhesiolysis, only that volume of adhesive dissection was assumed, which was necessary to ensure adequate surgical access and perform the stoma takedown in the elective surgery. Complete adhesiolysis was understood as the dissection of all adhesions along the the small intestine. The severity of intra-abdominal adhesions was assessed at the stage of surgical access using the peritoneal adhesive index (PAI). One patient from the control group was excluded due to the presence of a rough cicatricial adhesive process along the small intestine (L3 stage according to PAI).

The main group included 24 (48%) men and 26 (52%) women, the control group included 27 (55%) men and 22 (45%) women, the cohorts did not differ by gender (p = 0.5). The average age of patients in the partial adhesiolysis group was 54.3 years, and in the complete adhesiolysis group was 58.1 years (p = 0.12). The distribution of groups as per the ASA scale classes did not differ. The patients of the main and control groups did not differ in the time interval that elapsed from the moment of Hartmann's procedure to Hartmann's reversal — 9.5 and 9 months, respectively (p = 0.6). Patients of both groups had previously undergone, on average, 2 or more operations on abdominal cavity (p = 0.9). In the groups of partial and complete adhesiolysis during primary Hartmann's procedure, acute peritonitis was detected in 29 (58%) and 24 (49%) patients, respectively (p = 0.4). It is also worth noting that over 50% of the patients in both partial and complete adhesiolysis groups were operated on for a complicated diverticular disease — in 28 (56%) and 27 (55%) cases, respectively (p > 0.9). Operations for other colorectal diseases were performed rare (Table 1). In order to evaluate the results of reconstructive procedures in late postoperative period, the patients were interviewed for re-operations, as well as undesirable symptoms indicating the manifestation of adhesive disease [22].

Statistical Analysis

Patient data was entered into a Microsoft Excel 2019 for Windows spreadsheet. Statistical processing of the parameters was carried out using the Graphpad Prism software (version 8.4.3). Continuous data were presented in the form of averages indicating standard deviations with a normal distribution of the sign.

With an asymmetric distribution, variables were described using medians and quartiles (25%; 75%).

The distribution of signs was evaluated using the D'Agostino-Pearson test. Statistical evaluation of differences for continuous variables was carried

Table 1. *Characteristics of patient groups*

Parameter	Partial adhesiolysis (*n* = 50)	Complete adhesiolysis (*n* = 49)	*p*
Gender, *n* (%)			0.5*
Male	24 (48%)	27 (55%)	
Female	26 (52%)	22 (45%)	
Age, years (M ± SD)	54.3 ± 12.7	58.1 ± 12.1	0.12**
BMI, kg/m^2 (M ± SD)	29.4 ± 6.4	27.9 ± 3.9	0.16**
ASA, *n* (%)			0.88*
ASA I	7 (14%)	6 (12.2%)	
ASA II	27 (54%)	29 (59.2%)	
ASA III	16 (32%)	14 (28.6%)	
Time before HR (Me, Q1; Q3), months	9.5 (6; 16)	9 (6.8; 14.5)	0.6***
Abdominal surgery in history (Me, Q1;Q3), *n*	2 (1; 2)	2 (1; 2.5)	0.9***
History of peritonitis, *n* (%)	29 (58%)	24 (49%)	0.4*
Indications for Hartmann's procedure, *n* (%):			1.0*
Diverticular disease	28 (56%)	27 (55%)	
Colorectal cancer	12 (24%)	13 (27%)	
Volvulus of the sigmoid colon	1 (2%)	1 (2%)	
Mesenteric thrombosis	1 (2%)	1 (2%)	
Others	8 (16%)	7 (14%)	
Type of Hartmann's procedure, *n* (%):			0.5*
Sigmoid resection	42 (84%)	38 (76%)	
Left colon resection	4 (8%)	4 (8%)	
Left hemicolectomy	2 (4%)	6 (12%)	
Resection of the transverse colon	2 (4%)	1 (2%)	
Type of stoma, *n* (%):			0.6*
Sigmostoma	42 (84%)	38 (78%)	
Descendostoma	4 (8%)	4 (8%)	
Transversostoma	4 (8%)	7 (14%)	

*Note: M — arithmetic mean, SD — standard deviation, Me — median; Q1, Q3 — 25% and 75% quartiles, BMI — body mass index; * — Fisher test; ** — Student's t-test; *** — Mann-Whitney test*

out using the Student's t-test, with an asymmetric distribution using the Mann-Whitney U-test. To assess the differences in qualitative characteristics, the Fisher's exact test or the χ^2 was used. The statistical significance of the differences was recognized at a value of $p < 0.05$. In order to find risk factors for morbidity rate, a univariate analysis was performed using the logistic regression method.

RESULTS

The time of HR in the partial adhesiolysis group was 222 minutes, in the complete adhesiolysis group was 205 minutes ($p = 0.9$). The groups were homogeneous in the time interval from the beginning of the operation to the anastomosis formation ($p = 0.09$). The severity of peritoneal adhesions, assessed intraoperatively using the PAI index, did not differ in both groups ($p = 0.3$). The median adhesiolysis time in the partial adhesiolysis group was 10.5 minutes, while for complete adhesiolysis it took 28 minutes; this difference was significant ($p = 0.001$). Lesion of the intestinal wall during adhesiolysis occurred in 18 (36%) patients with partial and in 19 (39%) patients with complete adhesiolysis ($p = 0.8$). In 22% of cases, both with incomplete and complete adhesiolysis, the preventive ileostomy was performed ($p > 0.9$). In 17 (34%) patients in the main group and in 13 (26%) ones in the comparison group, anterior abdominal wall plastic surgery was required due to the presence of a postoperative ventral hernia; no significant differences were found in this parameter ($p = 0.5$). It should be noted that in most cases in both groups, hernioplasty was performed using a mesh implant ($p = 1.0$) (Table 2).

Postoperative complications developed in 21 (42%) cases in the main group and in 14 (29%) cases in the control, while no significant differences

Table 2. *Characteristics of operations in groups*

Parameter	Partial adhesiolysis (*n* = 50)	Complete adhesiolysis (*n* = 49)	*p*
Operation time (Me, Q1; Q3), min	222 (159; 280)	205 (180; 263.5)	0.9**
The time before the anastomosis formation (M ± SD), min	97.6 ± 31.3	110.4 ± 43	0.09*
Adhesiolysis time (Me, Q1; Q3), min	10.5 (5; 23.5)	28 (20; 49)	0.001**
PAI (M ± SD)	12.3 ± 4.4	13.3 ± 4.5	0.3*
Intestinal wall lesion, *n* (%)	18 (36%)	19 (39%)	0.8***
Preventive ileostomy, *n* (%)	11 (22%)	11 (22%)	1.0***
Plastic surgery of the anterior abdominal wall, *n* (%) With local tissues, *n* (%) With mesh implant, *n* (%)	17 (34%) 4 (23.5%) 13 (76.5%)	13 (26%) 3 (23%) 10 (77%)	0.5*** 1.0***
Postoperative hospitalstay (Me, Q1; Q3)	12 (9; 14.5)	11 (9; 13)	0.7**

*Note: M — arithmetic mean, SD — standard deviation, Me — median; * — Student's t-test; ** — Mann-Whitney test; *** — Fisher test*

Table 3. *Characteristics of postoperative complications according to the Clavien-Dindo scale*

Parameter	Partial adhesiolysis (*n* = 50)	Complete adhesiolysis (*n* = 49)	*p*
I class Seroma, *n* (%)	12 (24%)	8 (16%)	0.5*
II class Post-op ileus, *n* (%) Pelvic abscess, *n* (%)	4 (10%) 0	4 (8%) 1 (2%)	> 0.9*
III class Anastomosis leakage, *n* (%) Perforation of the large intestine, *n* (%) Bleeding, abdominal abscess, *n* (%)	2 (4%) 1 (2%) 1 (2%)	1 (2%) 0 0	0.4*
IV class	0	0	–
V class Mortality, *n* (%)	1 (2%)	0	> 0.9*

*Note: * Fisher's exact test*

were found ($p = 0.2$). Most of complications were Clavien-Dindo I and II. At the same time, subcutaneous tissue seroma was drained in 12 (24%) patients of the main group and in 8 (16%) patients of the control group ($p = 0.5$). Postoperative ileus developed in 4 (10%) and 4 (8%) cases in the groups of partial and complete adhesiolysis, respectively ($p > 0.9$). In one patient from the group of complete adhesiolysis, a pelvic abscess required conservative treatment. Re-operations for postoperative complications were in 4 patients of the partial adhesiolysis group. At the same time, 2 (4%) patients were operated on for the colorectal anastomosis leakage, 1 (2%) patient — for colon perforation.

In another 1 (2%) case, re-operation was performed for bleeding from the area of the postoperative wound of the anterior abdominal wall. Later, this patient was operated on again due to abdominal abscess. In the group of complete adhesiolysis, anastomosis leakage was diagnosed in 1 (2%) patient, for which conservative treatment with a positive effect was carried out. The leakage was cured, and the patient was discharged from the hospital in a satisfactory condition. In the main group, one fatal outcome was registered from acute myocardial infarction, which developed on the 8th day of the postoperative period (Table 3).

In order to determine the influence of demographic and intraoperative signs on the likelihood of postoperative morbidity, we performed a factor analysis. The following quantitative signs were included in the logistic regression: age, body mass index, time before HR, the number of previous abdominal operations, the value of the PAI index, as well as the operation time and the time before the anastomosis formation. The analysis also included categorical variables: gender, indications for Hartmann's procedure, smoking, the presence of peritonitis in the history, ASA, the fact

Table 4. *Regression analysis of the probability of postoperative complications*

Factor	Univariate analysis	
	OR (95% CI)	*p*
Gender (m)	0.63 (0.3–1.5)	0.3
Age	1.01 (0.97–1.04)	0.6
Body mass index > 35 kg/m^2	5.3 (1.5-21.2)	0.01
Indications for primary surgery Diverticular disease	0.9 (0.4–2.03)	0.7
Cancer	0.6 (0.2–1.6)	0.3
Others	1.1 (0.3–3.3)	0.9
Peritonitis	0.6 (0.2–1.3)	0.2
Smoking	1.1 (0.4–2.7)	0.9
ASA class	1.3 (0.7–2.7)	0.4
Time before HR	1.0 (0.99–1.01)	0.8
Number of operations	1.4 (0.9–2.1)	0.07
PAI	1.1 (1.0–1.2)	0.2
Complete adhesiolysis	0.7 (0.3–1.7)	0.4
Ileostomy	0.7 (0.2–2.0)	0.6
Intestinal wall lesion	1.2 (0.5–2.9)	0.6
Operation time	1.004 (0.99–1.01)	0.2
Time before anastomosis formation	1.0 (0.9–1.01)	0.8
Plastic surgery of the anterior abdominal wall	2.0 (0.8–4.9)	0.13
Plastic surgery of the anterior abdominal wall with local tissues	0.8 (0.1–4.0)	0.8
With a mesh implant	2.4 (0.9–6.3)	0.07

of complete adhesiolysis performed, ileostomy, the intestinal wall lesion, as well as plastic surgery of the anterior abdominal wall. It should be noted that the logistic regression formula did not include rare signs such as sigmoid colon volvulus and mesenteric thrombosis in the anamnesis. As a result, it was found that the only factor influencing the development of postoperative morbidity was the body mass index (OR = 1.1; 95% CI: 1.02–1.2; p = 0.02). A ROC analysis was also performed, where a cut-off point, with a value > 35 kg/m^2 was determined for this sign (OR = 5.3; 95% CI: 1.5–21.2; p = 0.01) (Table 4). Thus, it was found that a BMI exceeding 35 kg/m^2 increases the chance of postoperative complications after HR by over 5 times compared to lower index values.

In the late postoperative period, we followed 43 patients: 24 patients from the main group and 19 controls. The median follow-up was 20 months. It should be noted that during this period, none of the patients had hospitalizations for adhesive intestinal obstruction, and re-operations were also not performed. The incidence of postoperative ventral hernia did not differ significantly between groups. Hernias were diagnosed in 2 (8%) patients in the main group, and in 2 (11%) patients in the control (p > 0.9). During the year after the HR, 6 (25%) patients after partial adhesiolysis periodically experienced pain and abdominal distention, and three (13%) patients felt discomfort in the surgery area. In the group of complete adhesiolysis, similar symptoms were noticed in 4 (21%) and 3 (16%) patients, respectively (p > 0.9) (Table 5).

DISCUSSION

This study was for the effect of the volume of adhesiolysis on the early and late results of HR. The prerequisite for this study was the lack of understanding of the importance of the volume of adhesiolysis for safety and the results of end stoma takedown.

The studied groups of patients were comparable in demographic characteristics. The patients in the groups did not differ in history, such as the time before HR, the number of operations, and the level of stoma site. Both groups were comparable according to intraoperative data, such as the

Table 5. *Long-term results after Hartmann reversal procedure*

Parameter	Partial adhesiolysis (*n* = 24)	Complete adhesiolysis (*n* = 19)	*p**
Postoperative hernia	2 (8%)	2 (11%)	> 0.9
Re-operations	0	0	–
Pain	6 (25%)	4 (21%)	> 0.9
Distention	6 (25%)	4 (21%)	> 0.9
Discomfort	3 (13%)	3 (16%)	> 0.9

*Note: * Fisher's exact test*

severity of the adhesions, the operation time, and the incidence of the intestinal wall lesion during adhesiolysis. The analysis of the results obtained allows us to conclude that an increase in the volume of adhesiolysis did not significantly affect the traumatic nature of the surgery and its time. It should be emphasized that the number of patients in this study was chosen empirically, and the study with a similar design was done for the first time. The PAI index used in this work to assess the severity of adhesions was proposed by Italian surgeons [21] and is a convenient tool for quantifying the severity of the adhesions. The growing interest of Russian and foreign authors in the use of this index, as well as its convenience, were the basis for its application in the study. However, we noted that this classification does not fully take into account the geometric site of adhesive strands, which, in our opinion, is its disadvantage. It should also be noted that the number of points awarded to the adhesions in each specific region of the peritoneal cavity reflects only the fact of the presence of adhesions, without taking into account their number. Thus, it can be concluded that the prevalence of adhesions remains a difficult to measure and requires the development of a more detailed classification that provides for the possibility of quantitative analysis.

In the early postoperative period, 21 (42%) complications were reported in patients of the main group, and 14 (29%) ones in patients of the control group. The resulting difference in the groups, however, was not significant ($p = 0.2$). According to literature data, the rate of postoperative complications when performing stoma takedown through laparotomy is from 30% to 50% [3,4,16,23]. As a result of the meta-analysis, 26 randomized trials ($n = 13,740$) by Guerra et al. (2019) reported 29.3% of postoperative complications in patients who underwent HR [3]. Given the absence of significant differences in the postoperative morbidity rate between the groups of partial and complete adhesiolysis, it can be concluded that an increase in the adhesiolysis volume does not significantly affect the morbidity rate.

As a result of our regression analysis, it was found that the only factor that increases the likelihood of morbidity is a body mass index over 35 kg/m^2, which is generally consistent with the results of studies published earlier. So, in the study by Khomyakov E.A. et al. (2017) it was demonstrated that a BMI above 25 kg/m^2 increases the likelihood of postoperative ileus by 2.5 times [24]. According to Nikolian V. et al. (2017) patients with a body mass index over 30 kg/m^2 have a 2-fold increased risk of colorectal anastomosis leakage [25]. It should also be noted that neither complete adhesiolysis nor the severity of the adhesive process included in the regression analysis had an effect on the likelihood of complications.

CONCLUSION

Based on the results of the study, we can conclude that the volume of adhesiolysis during Hartmann's reversal does not affect the postoperative morbidity rate in the early and late postoperative period. Given this fact, the decision on the need for complete adhesiolysis may be left to the choice of surgeon, depending on the specific surgical situation.

AUTHORS CONTRIBUTION

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