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## RESEARCH ARTICLE

# DIVERTING ILEOSTOMY REVERSAL COMPLICATIONS IN PATIENTS WITH BENIGN VERSUS MALIGNANT CONDITIONS

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### ABSTRACT

**Background:** Reversal of ileostomy after surgery and chemoradiation creates a new group of patients with the potential for eventual postoperative complications. We aim to compare the postoperative morbidity of colorectal cancer patients with that of patients who underwent reversal of ileostomy for benign colorectal conditions. **Methods:** A retrospective analysis of patients undergoing ileostomy reversal was performed. Demographic, clinicopathologic features of patients, morbidity, initial diagnoses as well as rates of postoperative complications were analyzed. All complications after reversal of ileostomy were registered and classified according to Clavien-Dindo severity score. **Results:** 61 patients were divided in two groups; group A (21/61, 34.4%), included patients with benign colorectal diseases. The average time interval to reversal was 5.6±2.3 months and the in-hospital stay was 9.6±4.64 days. The overall complication rate was 33.3% (7/21) with wound infection rate at 14.3% (3/21). In group B (40/61, 65.6%), patients with malignancies maintained the ileostomy for an average of 8.2±3.3 months. In-hospital stay was 15.47±24 days and the overall complication rate was 65% (26/40). Wound infection was the most common complication with an incidence rate of 22.5%. The majority of complications in both groups was classified as Clavien-Dindo II and IIIa (14/61, 23%) while 9 patients (9/61, 14.8%) had Clavien-Dindo score IIIb and IV. **Conclusion:** Reversal of ileostomy in cancer patients is correlated with a high complication rate. Wound infection and postoperative ileus were the most common complications. Cancer patients with reversal ileostomy had increased hospital in stay and delayed closure compared to patients with benign diseases.

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## INTRODUCTION

Construction of a protective loop ileostomy is often performed during major colorectal operations. The aim is to protect the anastomosis, to decrease the rate of anastomotic leak and its consequences. The protective ileostomy is supposed to be temporary; however in about 20-33% of all patients, the ileostomy will not be reversed for different reasons (Marcin Zeman, 2020). At the present time, the number of protective ileostomies is increasing, as more patients with rectal cancer, are treated with neoadjuvant therapy and a protective ileostomy is performed after low anterior resection and total mesorectal excision.

To date, the morbidity and mortality after reversal of loop ileostomies varies in published series, reporting a wide range of complication rates from 17% to more than 45% (Gessler, 2012). A loop ileostomy is usually performed as a temporary measure after either right or left colon surgery; it is most commonly performed in patients with locally advanced rectal cancer. As the treatment of rectal cancer is multi-disciplinary with administration of chemotherapy and radiation prior to the radical surgery, the formation of a protective loop ileostomy at the time of resection is standard practice. The most common operation performed is the low anterior resection of the rectum with total mesorectal excision. Postoperatively, patients undergo adjuvant chemotherapy and some weeks after the end of chemotherapy the reversal of ileostomy follows.

An alternative strategy is the total neo-adjuvant therapy which involves administration of chemoradiation plus neoadjuvant chemotherapy prior to surgery. To date, there are not guidelines about the optimum timing of ileostomy reversal. The time of reversal, in patients without risk factors for morbidity after creation of ileostomy, is usually 2-3 months after the primary operation. Early closure of ileostomy within a few weeks after surgery may be performed in selected patients although this closure is not routinely recommended (Bakx *et al.*, 2003). On the other hand, delayed closure of the ileostomy (more than 6 months after the initial operation) is associated with higher rates of postoperative complications (Bausys *et al.*, 2019). Reversal of ileostomy is considered a straight forward surgical operation although postoperative complications should not be ignored; the majority of postoperative complications are minor and they are classified as ClavienDindo II severity score (Dindo, 2004), however, severe complications or the need for reoperation have been repeatedly reported. The goal of our study is to compare the morbidity and mortality between patients with benign disease and colorectal malignancy

## METHODS

**Study design:** A retrospective case control study of 61 patients with analysis of ileostomy reversal in our hospital the last 5 yrs. was performed (Research article ID number, 279/2022). Patients were divided in two groups; group A patients (N=21) had benign colorectal diseases and group B patients (N=40) had malignant colorectal diseases; the majority (N=30) had advanced rectal cancer treated by surgery and the standard oncologic protocol for the advanced rectal cancer, 5 had other colonic malignancies with postoperative chemotherapy and 5 early rectal cancer with surgery alone as option therapy. The integrity of rectal anastomosis before the closure of ileostomy was investigated in all patients by digital examination, endoscopy and CT scan. Patients without signs of anastomotic leak after the main operation were included in the analysis, while patients with anastomotic leak after the primary operation were excluded from analysis. Moreover, cancer patients of group B underwent a restaging before ileostomy reversal; only patients who were considered free of disease were included in our study.

**Study variables:** Demographic, clinic-pathological features of patients', and initial diagnoses were analyzed. All complications after reversal ileostomy were registered and classified according to Clavien-Dindo severity score. No postoperative deaths occurred (Clavien-Dindo score V). Complications registered were those specific to surgery, or general complications. In-hospital bowel dysfunction after reversal of ileostomy was registered, with emphasis in prolonged postoperative ileus (PPOI) and functional diarrhea. PPOI was defined as; the delay in oral feeding more than 6 days, as well as one or more of the following symptoms after the closure of ileostomy: abdominal distention, vomiting and replacement of nasogastric tube, no gas exit, abdominal colicky pain and signs of bowel dilatation in abdominal X-ray, with exclusion of anastomotic leak. There was no attempt to register delayed complications such as Low anterior Resection Syndrome, sexual dysfunction or long term faecal incontinence. The in-hospital stay after the closure of ileostomy was registered in all patients.

**Statistical analysis:** Data were expressed as mean± standard deviation for continuous symmetrically distributed variables and as frequency (percentage %) for categorical data. In cases where comparisons were performed between symmetric and non-symmetric variables, all descriptive statistics are provided, in order to increase clarity. The normality of the distributions was assessed with Kolmogorov-Smirnov test and graphical methods. Comparisons of continuous variables were performed using Student t test. Categorical data were compared by the chi-square test or Fisher exact test, as required. All tests were 2-sided. Differences were considered as significant if the null hypothesis could be rejected with >95% confidence interval ( $P < 0.05$ ).

## RESULTS

**Group A:** Twenty one patients were identified, with a mean age of 58.8 years (SD=15.8) and male to female ratio of 1:1. In 11 patients (11/21, 52.4%) the ileostomy was performed during an elective colorectal surgical operation and in 10 patients (10/21, 47.6%) during an emergency surgical operation. Fifteen patients (15/21, 71.4%) had left and 6 patients (6/21, 28.6%) right colon sided surgical diseases. The most common cause for creating a loop ileostomy was the left colon surgery for acute diverticulitis in 10 patients (10/21, 47.6%). Colovisceral fistulas, rectal prolapse, benign and large dysplastic rectal entities were the other left colon located pathologies. Regarding the right colon, emergency right hemicolectomy for vascular disorders was the most common operation (Patients' characteristics are summarized in table 1). The time to reversal of the ileostomy was 3-11 months, with a mean time of 5.6 months (SD=2.3). After the reversal of the ileostomy, the mean hospital stay was 9.6 days (SD=4.64). Surgical complications that occurred in this group are summarized in Table 2. Wound infections occurred in 3 patients (ClavienDindo score II in 2 patients and IIIa in one), 2 patients were re-operated (ClavienDindo score IIIb) due to anastomotic leak, and 1 patient was treated in ICU (ClavienDindo score IV) after the reversal of ileostomy and reoperation. One patient suffered a mild stroke. Postoperative ileus was present in 2 patients (2/21, 9.5%). Complications rate was 23.8% (5/21) or 33.3% (7/21) including patients with bowel dysfunction. Mortality was 0%.

**Group B:** Forty patients were identified, with a mean age of 66.9 years (SD=9.8) and a male-to-female ratio of 1.2:1. Patients were divided in 3 subgroups as following: a) Subgroup B1: 30 patients (30/40, 75%) with locally advanced rectal cancer who underwent neo-adjuvant chemo radiation, low-anterior rectal resection with TME and adjuvant chemotherapy, before the reversal of the ileostomy. All operations were elective, while 4 patients (4/30, 13.3%) had a single liver metastasis resected simultaneously. b) Subgroup B2: 5 patients (5/40, 12.5%) had a protective ileostomy formed due to other colonic malignancies; 3 patients had large bowel obstruction of the right colon and underwent emergency right hemicolectomy, whereas in one patient, a single liver metastasis was removed simultaneously. Patient #4 received a double loop ileostomy due to anastomotic leak of the ileo-colic anastomosis after a right hemicolectomy. Patient #5 suffered from pelvic chondro-sarcoma and due to iatrogenic damage of the rectum during surgery, he received an ileostomy at the end of operation; this operation was the only elective in this subgroup. All patients received postoperative chemotherapy before the closure of ileostomy. c) Subgroup B3: 5 patients

(5/40, 12.5%) with early rectal cancer treated with low anterior resection (elective surgery) and protective ileostomy. No other therapies were used before the reversal of the ileostomy. No patient of this subgroup presented complications after the closure of ileostomy. The p-TNM classification system in group B was as following; T3=27/40, 67.5%, T4=7/40, 17.5% (T3+T4=advanced rectal cancer). T1=1/40, 2.5%, T2=4/40, 10% (T1+T2=early rectal cancer), T0=1/40, 2.5% (due to pathological complete response in neo-adjuvant therapy).

N0=25/40, 62.5%, N1=11/40, 27.5%, N2=4/40, 10%. M1=5/40, 12.5%. The time of ileostomy stay in group B was 2-16 months, (mean=8.2 months  $\pm$ 3.3). The mean in-hospital stay of group B patients was 15.47 days (SD=24), whereas 18 patients stayed longer than 10 days (18/40, 45%). Personal Surgical History, priority and staging of Group B patients are shown in table 3. Complications after the reversal of the ileostomy occurred in 16 patients (16/40, 40%) or in 26(26/40, 65%), including patients with functional bowel disorders (Prolonged Postoperative Ileus and diarrhea). The most prominent complication was wound infection, which occurred in 9 patients (9/40, 22.5%); 2 patients had wound infection with CD score IIIb, 3 patients wound infection with CD score IIIa, and 4 patients had wound infection with CD II score. Postoperative bowel obstruction with Clavien-Dindo score IIIb presented 2 patients, while 1 patient developed superior mesenteric artery embolism (Clavien-Dindo score IIIb). Two patients developed an anastomotic leak postoperatively; one with abscess development (CD IIIa) and one with development of entero-cutaneous fistula (CDIIIb). Urinary infection Clavien-Dindo score II in 1. Diarrhea (3-6 bowel movements/day) Clavien-Dindo score II in 2. Pulmonary embolism CD II score in one, functional post-operative ileus in 8(8/40, 20%) and functional diarrhea in 2 (2/40, 5%). Six patients were re-operated (6/40, 15%), (Table 4, complications rates in Group B). Further statistical analysis showed that group B patients were significantly older than patients of group A (66.9 years vs. 58.8 years,  $P=0.05$ ), they also were hospitalized for a longer period of time (15.4 vs 9.6 days,  $P<0.001$ ); nevertheless complication rates between two groups were not statistically significantly different (Table 5, statistical analysis).

## DISCUSSION

The creation or reversal of a protective ileostomy is considered a technically straight forward surgical operation. The time to reversal of the ileostomy exposes patients to several complications and increasing the time to reversal, complications rate up to 70% may be observed, the most common are; peristomal dermatitis, dehydration, renal failure, the need for parenteral nutrition, parastomal hernia, prolapse, retraction and stenosis (Shabir, 2010). Before the closure of the ileostomy, risk factors for non- reversal ileostomy should be detected as; stage IV cancer, severe anastomotic leak of the protected anastomosis, and non -surgical complications and comorbidities. In case of anastomotic stricture due to scarring or radiotherapy, the reversal of ileostomy is contraindicated (Zhu *et al.*, 2017). Reversal of ileostomy is a low priority elective surgical operation, and has to compete on the waiting list with more urgent operations; this factor seems to be important for a delayed closure of ileostomy. Other factors as age, end- ileostomy versus loop-ileostomy and not loop ileostomy, high Body Mass Index and preoperative radiotherapy may influence the time of closure of an ileostomy

(Sier, 2015). Patients with evidence of anastomotic leak may not be candidates for reversal, especially if symptoms remain for more than one year. Even though the possibility of failure to reverse an ileostomy is high(>20%), we must consider that the care of ileostomy is more difficult than a colostomy, and the latter is preferable as a final solution (Celerier, 2016). For the future and for the patients undergoing low anterior resection we are waiting the results and indications of the ‘ghost ileostomy’, a technique well described and currently under evaluation, which is hoped to avoid the complications of an ileostomy and a second operation for the closure of ileostomy (Hüttner, 2020). The early closure of an ileostomy within 2 weeks after the low anterior resection may be safe and provide some benefits for selected patients, but it cannot be applied to the majority of patients (Menahem, 2018). The time of reversal is reported either as a significant predictor of morbidity(12) by some, while other studies show an increased complication rates if the interval between primary operation and reversal of ileostomy is shortened (Perez, 2006). Finally, a delayed closure of more than 6 months raises the postoperative complications. At the present study the mean time to reversal of the loop ileostomy was 5.6months (range 3-11months) in patients with benign conditions and significantly increased in 8.2months for patients with malignancy (range 2-16mo), ( $p=0.05$ ). This increased time for the closure, in patients with malignancy is well justified, by the time needed for the adjuvant chemotherapy. We consider this waiting time of 8.2 mo. for reversal in cancer patients, as reasonable time for two reasons; firstly the necessary for most patients postoperative recovery time of 2-3 months, including the time for settlement of many postoperative complications, secondly the needs to be an interval for adjuvant treatment. There is additional administrative time common in all hospitals (Mateusz Rubinkiewicz, 2019), which is the same in benign diseases (<6mo). In daily practice, patients with advanced rectal cancer, postoperative complications and adjuvant chemotherapy have little chance for a closure of ileostomy under 6months, after the ileostomy formation.

The length of hospital stay after the closure varies in different reports from 3-4 days (in uncomplicated cases) up to some weeks, depending on postoperative complications. At the present study, the time of stay was from 4-19days (mean 9.6days) in patients with reversal in benign colorectal conditions, while reversal in cancer patients was statistically significantly increased from 4-158days (mean15.4days), ( $p<0.001$ ). In cancer patients, no patient had a hospital stay more than 28days after the closure, except the one with 158 days care due to heart comorbidities, severe intra-abdominal vascular disorders and reoperations. 45% of cancer patients had an increased hospital stay >10days after reversal. In group A, 10/21, 47.6% of patients underwent loop ileostomy during emergency surgery for conditions of the right colon. In group B ileostomy was performed as elective procedure during the primary surgery (subgroup B1 and B3) and only in 4 cases as emergency (4/40, 10%) in right colon surgery (subgroup B2)(see table 2,4). In patients with benign colorectal conditions emergency surgery with loop ileostomy is more common than emergency surgery in patients with colorectal cancers ( $p<0.001$ ). All patients with advanced rectal cancer in our study (subgroup B1), after neo-adjuvant therapy, had a suitable interval time for the primary operation and the creation of ileostomy. This interval ranges from 6-12 weeks in most reports (Glynne-Jones, 2017; Aris Plastiras, 2018).

**Table 1. Ileostomy reversal in Group A patients; (N=21, benign colorectal conditions)**

<i>Nr.</i>	<i>Main disease- Personal surgical History</i>	<i>Priority</i>	<i>Operations followed by loop ileostomy</i>
4	Acute diverticulitis- Hinchey III	Emergency	Sigmoidectomy-anastomosis
2	Complicated acute diverticulitis- Stenosis	Elective	Sigmoidectomy-anastomosis
4	Acute diverticulitis Hinchey IV -Hartmann	Elective	Restoration Hartmann
1	Colonoscopic perforation of sigmoid colon. Hartmann procedure	Elective	Restoration Hartmann
2	1. Recto-vesical, 2.High recto-vaginal fistula	Elective	Low anterior resection
1	Rectal prolapse	Elective	Resection of redundant rectosigmoid colon- Anastomosis
1	High grade dysplasia, large villous adenoma>5cm	Elective	Low anterior resection
1	Car accident-entero-mesenteric trauma	Emergency	Local resection of the terminal ileum-anastomosis
2	Acute mesenteric ischemia of the right colon-terminal ileum	Emergency	Right hemicolectomy-anastomosis
1	Intestinal perforation- Churg Strauss Vasculitis	Emergency	Local resection of the terminal ileum-anastomosis
1	Angiodysplasia of the right colon-acute bleeding-fail of vascular embolism	Emergency	Right hemicolectomy-anastomosis
1	Terminal ileum obstruction-gallstone	Emergency	Local excision of the terminal ileum-anastomosis
<b>Total</b> <b>21</b>		Emergency: 10/21,47.6% Elective: 11/21,52.4%	Operations on left colon- rectum: 15(15/21, 71.4%) Operations on the right colon-ileum: 6(6/21, 28.6%)

**Table 2. Complications rates in Group A patients; (N=21, benign colorectal conditions)**

<i>Complications</i>	<i>N</i>	<i>%</i>
Wound infection	3	14.3
Anastomotic leak	2	9.5
Stroke	1	4.8
PPOI <sup>a</sup>	2	9.5
Reoperation	2	9.5
CD <sup>b</sup> score II+III <sub>a</sub>	4	19
CD score III <sub>b</sub>	2	9.5
CD score IV	1	4.8

a) PPOI: prolonged postoperative ileus,

b)CD= Clavien-Dindo score

**Table 3. Personal Surgical History, priority and staging of Group B patients (N=40, malignant colorectal diseases)**

<i>Nr=40</i>	<i>Main disease- Personal surgical History</i>	<i>Priority</i>	<i>Operations followed by loop ileostomy</i>	<i>p-TNM<sup>a</sup> classification Group B</i>
B1=30	Advanced RC. Single metastasis in 4. Neo adjuvant therapy, surgery and postoperative adjuvant chemotherapy before the closure of ileostomy	Elective	LAR <sup>b</sup> , TME <sup>c</sup> . Hepatectomy in 4 patients	T0=1(1/40, 2.5%) T0 due to p-CR <sup>d</sup> T1=1(1/40, 2.5%) T2=4(4/40, 10%) T1+T2= EarlyRC <sup>e</sup> T3=27(27/40, 67.5%) T4=7(7/40, 17.5%) T3+T4=Advanced RC
B2=5	4 colonic cancers, 1pelvic tumor. Postoperative adjuvant chemotherapy	4 emergency, 1 elective	-right hemicolectomy:3 (in one hepatectomy) -peritonitis:ileocolic reconstruction:1 -rectal iatrogenic trauma:1	N0=25(25/40, 62.5%) N1=11(11/40, 27.5%) N2=4 (4/40, 10%) M=5(5/40, 12.5%)
B3=5	Early rectal cancer. No chemoradiation	Elective	LAR	

a) p-TNM=pathological TNM, b)LAR=Low Anterior Resection, c)TME=Total mesorectal Excision, d) p-CR= pathological Complete response, e) RC= Rectal Cancer

**Table 4: Complications rates in Group B patients; (N=40, colorectal malignancy)**

<i>Complications</i>	<i>N</i>	<i>%</i>
Wound infection	9	22.5
Wound dehiscence	2	5
Bowel obstruction	2	5
SMA <sup>a</sup> thrombosis	1	2.5
Anastomotic leak	2	5
Entero-cutaneous fistula	1	2.5
Urinary infection	1	2.5
Pulmonary embolism	1	2.5
PPOI <sup>b</sup>	8	20
Functional diarrhea	2	5
Reoperations	6	15
CD <sup>c</sup> score II	6	15
CD score III <sub>a</sub>	4	10
CD score III <sub>b</sub>	6	15

a) SMA=Superior Mesenteric Artery, b)PPOI=Prolonged Post-Operative Ileus,

**Table 5. Statistical analysis in patients with reversal ileostomy in benign (Group A, N=21) and malignant colorectal diseases (Group B, N=40). Univariate analysis**

Reversal ileostomy-Parameters	Group A, N=21	Group B, N=40	Statistical analysis
Ileostomy stay(months)	Mean=5.6	Mean=8.27	p=0.01
Length of stay(days)	Mean=9.6	Mean=15.4	p<0.001
Gender			p=0.445
Male	11	25	
Female	10	15	
Mean age	58.8	66.9	p=0.05
Priority			p=0.001
Emergency priority	10	4	
Elective priority	11	36	
Complications	5	16	p=0.206
Wound infections	2	9	p=0.210
PPOI <sup>a</sup>	2	8	p=0.294
Functional diarrhea	0	2	p=0.297
CD <sup>b</sup> score II+ III <sub>a</sub>	3	10	p=0.332
Reoperations-CD IIIb	2	6	p=0.591

a) PPOI=Prolonged Post-Operative Ileus, b) CD= Clavien-Dindo score

In patients with advanced rectal cancer after the low anterior resection, Total Mesorectal Excision and protective ileostomy, with postoperative adjuvant therapy, an early closure of ileostomy is not recommended, as it yields a high complication rate. It seems that an optimal waiting time, is at least 109 days after the creation of ileostomy (Yin, 2017). Adding the time to treat complications and the adjuvant chemotherapy postoperatively, makes the problem of time closure more complex, as adjuvant chemotherapy is an important factor of delay of closure of ileostomy (Frag, 2017). Morbidity rates for the closure of ileostomy, vary in the literature from 2-50% up to 71%. In the present study in group A, the complications rate was 23.8% or 33.3% if patients with postoperative ileus are added, while in group B it was 40% or 65% if we consider ileus and persistent diarrhea after the closure. Mortality was 0% in both groups, and despite the high complication rates, in the literature mortality rates range in low levels from 0-1.5%. The most common complications were wound infection and postoperative ileus, other complications were reoperations after closure, anastomotic leak, urinary infections, stroke, severe intra-abdominal vascular disorders and pulmonary embolism and they are shown in table 2 and 3. The distribution, severity and comparisons of complications, between group A and B is shown in table 3. The majority of complications had a Clavien-Dindo score of II and IIIa (easily treated during in hospital stay), while CD III b (necessitate reoperation) were registered in increased number in group B compared with group A. Only one patient of group A was Clavien-Dindo score IV (use of Intensive Care Unit). Prolonged Post-Operative Ileus is a common complication in colorectal surgery. In groups A and B occurred in 9.5% and 20% respectively. The incidence in the literature varies from 2-50%, it is multifactorial and may increase significantly, or even double the time of in hospital stay (19). As a functional disorder ileus should be differentiated from bowel obstruction caused by factors necessitating surgical operation; in our patients of group B, 2 patients (2/40, 5%) had bowel obstruction Clavien-Dindo score IIIb, caused by enteric adhesions after the reversal of ileostomy. Other functional disorders observed during in stay hospital, were 2 patients with persistent diarrhea after the closure of ileostomy in group B1, caused by neo-adjuvant therapy; Clostridium difficile and anastomotic leak were excluded. The problem of complications after the closure of ileostomy, is more complex, as in our study we did not examine two common late complications; a) the postoperative hernias in the site of reversal, or other incisional hernias; in the literature they represent 30-50% of patients, the majority are symptomatic and require a new operation

(Balazs Fazekas, 2016), b) Functional bowel disorders as the low anterior resection syndrome, genito-urinary dysfunction, and anal incontinence caused by the effects of radiation or surgery in patients with low anterior resection, Total Mesorectal Excision and eventual more extended pelvic operations. In literature the incidence of Low Anterior Resection Syndrome ranges from 42-46% (Ansari *et al.*, 2017; Chen *et al.*, 2015), genitourinary dysfunction from 36% in men, up to 57% in females (Ledeb, 2018).

In our study a special interest is giving in patients of group B regarding: a) the correct c-TNM classification of patients and the final the p-TNM classification after surgery, b) the neo-adjuvant therapy before the operation in patients with advanced rectal cancer, c) the adjuvant chemotherapy after surgery and before the closure of ileostomy; a) All patients were classified in c-TNM according to the ESMO Guidelines Committee for Rectal cancer for diagnosis, treatment and follow-up (Glynne-Jones, 2017), other classification TNM systems, according to the guidelines of the National Comprehensive Cancer Network for Rectal cancer (Benson, 2018) or the guidelines of the Japanese Society for Cancer of Colon and Rectum (JSCCR) (Watanabe, 2018) may be used, as there are similarities and differences, but they are comparable between them (Luzietti, 2018). In our study, the majority of patients (30/40, 75%) were of stage II (T3-T4, without nodal involvement) or III (with nodal involvement), and the most useful examination for staging was the pelvic-rectal MRI. 5 patients (5/40, 12.5%) were of stage IV (4 from subgroup B1 and 1 from subgroup B2) with M1 (single liver metastasis, small size <2cm, operable and resectable, without metastases elsewhere. Useful examinations, except MRI for local staging were the abdomen CT scan and PET scan in T4 and M1 patients. 5 patients (5/40, 12.5%) had early rectal cancer and the most useful examination for local staging was endo-rectal Ultrasounds. All patients of group B1 (advanced rectal cancer, N=30) in our study underwent neo-adjuvant therapy, radical surgical operation and ileostomy with adjuvant chemotherapy postoperatively. Over the last two decades the roles of surgery-radiation-chemotherapy, have changed many times in various protocols for rectal cancer therapy (Roeder, 2020). At the present time, for locally advanced rectal cancer, all guidelines recommend neo-adjuvant therapy for all T3, T4 (Stage IIA) lesions extending through the muscularis propria into the perirectal tissue, any loco-regional nodal metastases (Stage III), or distant metastatic disease stage IV (Glynne-Jones, 2017; Benson, 2018). After the radical surgery (low anterior resection and total mesorectal excision of the rectum) and

protective ileostomy, follows postoperative adjuvant chemotherapy; this therapy has been accepted worldwide as the standard treatment for patients with locally advanced rectal cancer (Ri, 2019), although few reports dispute the role of adjuvant chemotherapy, after the neo-adjuvant therapy and if the surgical operation is radical (Hang Zhang, 2020; Breugom, 2015). Further statistical analysis shows that reversal ileostomy in malignant colorectal cancer patients with advanced rectal cancer and standard chemoradiation protocol/or colonic cancer patients with preoperative chemotherapy (N=35, subgroup B1+B2) present statistically significantly higher complication rates compared with ileostomy reversal patients undergoing surgery alone as treatment option in benign colorectal conditions or early rectal cancer (Group A+ subgroup B3) , (p<0.05).

## CONCLUSION

Reversal of ileostomy in benign and malignant colorectal conditions, carries a complication rate up to 54% (33/61). Most complications are minor with Clavien-Dindo score II and IIIa. Reoperation rate due to severe postoperative complications at 13.1% (8/61). Cancer patients with reversal of ileostomy require increased hospital in stay and delayed closure compared to patients with benign diseases. Complications after closure in cancer patients were more common than in patients with benign conditions. Surgery for acute diverticulitis and rectal cancer are the most common reasons of formation and reversal of ileostomy in patients with benign and malignant conditions respectively. Emergency surgery in benign diseases is more common than in patients with cancer for the formation of an ileostomy and subsequent reversal.

**ABBREVIATIONS:** CD=Clavien-Dindo score, LAR=Low anterior resection, TME=Total Mesorectal Excision, c-TNM=clinical TNM, p-TNM=pathological TNM, p-CR=pathological complete response, PPOI=Prolonged Postoperative Ileus, CT=computerized Tomography, MRI=Magnetic Resonance Imaging, PET=Positron Emission Tomography

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## AUTHORS' CONTRIBUTIONS

All authors fulfill the 4 criteria of authorship according to the ICMJE recommendations and they approved the final submission

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