Elderly Patients with Colorectal Cancer – A Predisposed Category for Postoperative Complications

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Rezumat

Pacienți vârstnici cu cancer colorectal – o categorie predispusă la complicații postoperatorii

Introducere: Cancerul colorectal (CRC) se numără printre principalele cauze de deces cauzate de cancer în întreaga lume. Pacienții vârstnici sunt adesea considerați ca fiind o categorie cu risc crescut, predispuși la complicații postoperatorii.

Materiale și metode: 138 pacienți cu vârsta de peste 75 de ani și diagnosticați cu cancer colorectal au fost revizuiți retrospectiv. Pacienții au fost împărțiți în două grupuri: Grupul de studiu - pacienții care au dezvoltat complicații postoperatorii, și Grupul de control - pacienții fără probleme în perioada postoperatorie. Au fost comparate date clinice, preoperatorii, chirurgicale, postoperatorii și oncologice. Scopul studiului a fost de a determina posibili factori de risc în apariția complicațiilor postoperatorii și de a analiza influența acestora asupra mortalității.

Rezultate: Factori de risc cum ar fi sexul bărbătesc, obezitate, insuficiența cardiacă, diabet zaharat tip II, anemie severă, hipoproteinemie, clasificare ASA III-IV, intervențiile chirurgicale efectuate în urgență, timp operator îndelungat, sângerări semnificative intra-operatorie, internare prelungită, localizare distală a formațiunilor tumorale, stadiile TNM III-IV, antecedente de cancer digestiv operat sau alte operații abdominale majore necanceroase efectuate au fost identificați.

Concluzii: Tratatamentul chirurgical al cancerului colorectal în cazul populației cu vârstă înaintată rămâne o provocare, această categorie de pacienți trebuie să beneficieze de o atenție deosebită pentru a asigura o șansă de a minimaliza sau evita aceste complicații.

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Cuvinte cheie: vârstnici, cancer colorectal, complicații postoperatorii, evoluție nefavorabilă, atenție specială

Abstract

Introduction: Colorectal cancer (CRC) is among the leading causes of cancer-related deaths around the world. Elderly patients are often considered as a high-risk category of patients, predisposed for postoperative complications.

Materials and methods: 138 patients aged over 75 years and diagnosed with colorectal cancer were retrospectively reviewed. Patients were divided in two groups, as follows: Study Group including patients who developed postoperative complications, and Control Group including patients without problems in the postoperative period. There were compared clinical, preoperative, surgical, postoperative and oncological data. The aim of study was to determine possible risk factors for short-term postoperative complications and analyze of the influence of postoperative complications on survival.

Results: Risk factors as male gender, obesity, heart failure, diabetes type II, severe anemia, low total protein level, ASA III-IV classification, emergency surgery, prolonged surgical intervention, increased intraoperative blood loss, prolonged hospital stay, distal localization of tumors, TNM stages III-IV, surgery for digestive cancer and non-cancerous major abdominal surgery in the medical history were identified.

Conclusion: The surgical treatment of colorectal cancer in the aging population still remains a challenge, these category of patients should benefit of special attention in order to ensure a chance to minimize or avoid these complications.

Key words: elderly, colorectal cancer, postoperative complications, negative evolution, special attention

Introduction

Colorectal cancer (CRC) is among the leading causes of cancer-related deaths around the world, affecting same men and women. Despite the advances in surgical techniques and postoperative care, morbidity and mortality after surgery for colorectal cancer remains elevated. While life expectancy is increasing, the number of operations being performed on elderly patients is also growing, nearly one half of patients with colorectal cancer are aged over 70 years (1). However, elderly patients are often considered as a high-risk category of patients, predisposed for postoperative complications. Based on multiple studies, postoperative complications occur in up to one-third of patients undergoing colorectal procedures (2). Advanced age is usually accompanied by underlying

comorbidities, wich could seriously affect the outcomes of surgical treatment, furthermore these category of patients tend to present with more locally advanced or disseminated disease (3). In fact aging represents an independent risk factor after colorectal surgery for in-hospital morbidity and mortality as well, by reducing physiologicalrecuperative power (4). According to the previous, there can be stated that surgery for elderly with colorectal cancerhas become a major medical care issue.

Materials and Methods

Aim of Study and Patient Selection

The aim of the study was to determine possible risk factors for short-term postoperative complications during hospital stay in case of

elderly patients with colorectal cancer. Furthermore, we analyzed the relationship between postoperative complications and survival, underlining the possible negative influence on the outcome of patients.

In 2018 we conducted a retrospective case-control study in which were included a total of 138 patients aged over 75 years and diagnosed with colorectal cancer. Patients were admitted and followed surgical treatment at the 2nd Department of General Surgery of Mureș County Emergency Clinical Hospital of Târgu Mureș. In the present study we have analyzed the clinical observation sheets, operatory and anatomopathological protocols.

Subdivision of Patients and Collected Data

In the first part of the study, patients were selected and divided in two groups, based on the presence or absence of postoperative complications, as follows: Group with Postoperative Complications (Study Group - SG) – including 58 patients with developed complications in the postoperative period, and Group without postoperative complications (Control Group - CG) – including 80 patients without postoperative difficulties.

In order to determine independent risk factors for postoperative complications in elderly with colorectal cancer, for all patients there were carefully gathered data from medical charts, operatory and anatomopathological protocols. The followed details contained clinical, preoperative status related, intraoperative, postoperative and oncological informations. Clinical characteristics included patient's age, gender and medical history, focusing mainly on cardiac, pulmonary and surgical diseases. Preoperative status was determined by presence of neoadjuvant oncologic therapy, laboratory findings such as Hemoglobin and Hematocrit level, Total Protein level and also by calculating ASA score (American Society of Anesthesiology Score). In order to ease analyze of preoperative anemia, there were separated three groups of bloodlessness, as follows: Mild Anemia (Hb > 11 g/dl), Moderate Anemia (Hb 8-11 g/dl), Severe Anemia (Hb < 8 g/dl). The

analyzed surgical data comprised the character of surgery, location of the tumor, surgical intervention performed, necessity of stoma, presence of local invasion, presence of metastasis, intraoperative blood loss, need of intraoperative blood transfusion and duration of surgery. Regarding tumoral locations, there were distinguished right colon, left colon and rectal appearance of tumors. Right sided tumors containing malignancies of the cecum, ascending colon, liver flexure and transvers colon. Meantime left colon cancer involves splenic flexure, descending colon and sigmoid localization, while rectal localization of tumors were investigated separately. Three types of surgical interventions were separated, characterizing nature of surgical intervention: radical surgery, palliative intervention and inoperability. Radical surgery consisted of right hemicolectomy, left hemicolectomy, Reyard, Dixon and Miles operations, subtotal colectomy and the Hartmann's procedure during emergency interventions. Palliative surgical interventions were characterised by colostomy formation and limitation to internal derivation, while in some cases surgeons were forced to resign surgery, declaring inoperability of the case. In order to ease the classification of intraoperative blood loss, there were determined the following groups: Class I Hemorrhage (< 500 ml), Class II Hemorrhage (500-1000 ml), Class III Hemorrhage (1000-2000 ml) and Class IV Hemorrhage (> 2000 ml). Postoperative and oncologic data compared between the two groups included period of intensive therapy care, length of hospital stay and tumor staging.

In order to investigate the relationship between postoperative complications and possible negative evolution of patients, the second part of the study focused only on the group with postoperative complications (Study Group). Patients were evaluated and regrouped as follows: Patients with postoperative complications who deceased (DP) – including 11 patients who deceased after suffering post-operative complications, respectively Patients with postoperative complications who survived (SP) – including 47 patients without fatal evolution after

developing postoperative complications.

The purpose of this study was to evaluate the possible risk and protective factors for developing short-term postoperative complications. Because little is known about the impact of complications on patients mortality, this study also aimed to analyze whether a complicated postoperative evolution affects the survival in elderly patients.

Statistical Analysis

Collected information was processed using Microsoft Excel. The statistical analysis of the database was performed using Graph Pad InStat software (Graph Pad Software, Inc., San Diego, United States of America). Quantitative variables were presented by mean and median, while qualitative and categorical variables were expressed both as integer and percentage values. Anormality test was applied for all variable groups in order to determine the distribution of values. Furthermore, for the quantitative statistical

analysis, Student's t-test was applied for groups with Gaussian distribution of values, while Mann-Whitney nonparametric test was used for groups with non-Gaussian distribution. Inferential statistical analysis involving odds ratios determination for mentioned clinical, surgical and postoperative factors was performed using Fisher's Exact Test. The level of statistical significance for the present research was set at a p value of 0.05, while the confidence interval was 95% for all the calculated parameters.

Results

Table 1 shows the clinical characteristics and medical history and of patients, age being the first followed character. Mean age for SG was 76.87 years old, while in case of CG, mean age was 76.65 years old, without statistical significance. Also, there was observed a higher percentage of male patients (SG - 75.86%), male gender being a statistical significant risk factor for developing postoperative complica-

Table 1. Clinical data and patients medical history

	Study Group (Group with postoperative complications) n=58 (%)	Control Group (Group without postoperative complications) n=80 (%)	OR (odds ratio)	P value
<i>Age (years)</i>				
Mean	76.87	76.65	-	0.4655 NS
<i>Gender</i>				
Male	44 (75.86)	37 (46.25)	3.653	0.0005
Female	14 (24.14)	43 (53.75)	0.273	0.0005
<i>Patients Medical History</i>				
Obesity	20 (34.48)	8 (10)	4.737	0.0006
Arterial hypertension	34 (58.62)	44 (55)	1.159	0.7294 NS
Ischemic cardiomyopathy	36 (62.07)	42 (52.5)	1.481	0.2991 NS
Heart failure	14 (24.14)	8 (10)	2.864	0.0337
Myocardial infarction	2 (3.45)	6 (7.5)	0.440	0.4675 NS
Atrial fibrillation	8 (13.79)	6 (7.5)	1.973	0.2617 NS
COBP	4 (6.9)	2 (2.5)	2.889	0.2384 NS
Asthma	0 (0)	1 (1.25)	0.453	1.0000 NS
Pulmonary embolism	0 (0)	1 (1.25)	0.453	1.0000 NS
Diabetes Type I	2 (3.45)	1 (1.25)	2.821	0.5723 NS
Diabetes Type II	15 (25.86)	9 (11.25)	2.752	0.0392
Surgery for digestive cancer	6 (10.34)	0 (0)	19.93	0.0047
Other non-cancerous major abdominal surgery	21 (36.21)	17 (21.25)	2.103	0.0568

NS - not significant p value

tions, with an OR = 3.653 and P = 0.0005. Female gender appeared to be a statistically significant protective factor in the occurrence of postoperative problems (OR = 0.273, P = 0.0005). While analyzing patients medical history, there were observed that obesity (OR = 4.737, P = 0.0006), heart failure (OR = 2.864, P = 0.0337), diabetes type II (OR = 2.752, P = 0.0392), surgery for digestive cancer (OR = 19.93, P = 0.0047) and other major abdominal surgery (OR = 2.103, P = 0.0568) in the personal history increased the appearance of postoperative issues, being identified as independent risk factors for developing postoperative complications.

In *Table 2* information about preoperative status are presented. Inspecting neoadjuvant oncologic treatment appeared without any statistical significance in the development of postoperative complications. Evaluation of preoperative anemia resulted mild anemia as a protective factor in the development of postoperative complications (OR = 0.285, P = 0.0309), while severe anemia at the time of hospital admission represented an important risk factor in the buildout of postoperative difficulties (OR = 4.488, P = 0.0254). Furthermore, low total protein level resulted as a significant risk factor in the advancement of postoperative issues (OR = 3.459, P = 0.0010). The statistical analysis of ASA

classification resulted in significant statistical parameters regarding postoperative complications for patients in ASA III-IV groups (OR = 4.875, P = 0.0001), while ASA I-II categories were identified as protective factors in the development of postoperative problems (OR = 0.205, P = 0.0001).

In *Table 3* intraoperative assessments are shown. Statistical analysis of admission type resulted surgery in emergency conditions as a potential risk factor for developing postoperative complications (OR = 2.676, P = 0.0171), while elective surgical interventions seemed to be significant protective factors against postoperative problems (OR = 0.373, P = 0.0171). While examining the most frequent locations of colon tumors, there was detected that distal localization (rectum) of tumors were possible risk factors for postoperative complications (OR = 2.239, P = 0.0252), meantime tumors of the proximal colon seemed to be protective factors in the development of postoperative issues (OR = 0.297, P = 0.0059). Analyzing the performed surgical interventions, resulted radical surgery as a potential protective factor in the development of postoperative complications (OR = 0.320, P = 0.0531). Necessity of stoma during surgery was observed in 48.27 % for Study Group, and 31.25 % in case of Control Group, without any significant differences. Furthermore, local invasion of the

Table 2. Survey of preoperative status

	Study Group (Group with postoperative complications) n=58 (%)	Control Group (Group without postoperative complications) n=80 (%)	OR (odds ratio)	P value
<i>Neoadjuvant oncologic treatment</i>				
Chemotherapy	6 (10.34)	2 (2.5)	4.500	0.0689 NS
Radiotherapy	8 (12.79)	7 (8.75)	1.669	0.4112 NS
<i>Severity of preoperative anemia</i>				
Mild (>11 g/dl)	6 (10.34)	12 (15)	0.285	0.0309
Moderate (8-11 g/dl)	22 (37.93)	17 (21.25)	1.022	1.0000 NS
Severe (<8 g/dl)	13 (22.41)	3 (3.75)	4.488	0.0254
<i>Total Protein Level</i>				
Low Protein Level	28 (48.27)	17 (21.25)	3.459	0.0010
<i>ASA Classification</i>				
ASA I-II	16 (27.59)	52 (65)	0.205	0.0001
ASA III-IV	42 (72.41)	28 (35)	4.875	0.0001

NS - not significant p value

Table 3. Intraoperative assesment

	Study Group (Group with postoperative complications) n=58 (%)	Control Group (Group without postoperative complications) n=80 (%)	OR (odds ratio)	P value
<i>Character of surgical intervention</i>				
Elective	37 (63.79)	66 (82.5)	0.373	0.0171
Emergency	21 (36.21)	14 (17.5)	2.676	0.0171
<i>Tumor location</i>				
Right colon	8 (13.79)	28 (35)	0.297	0.0059
Left colon	16 (27.59)	21 (26.25)	1.070	1.0000 NS
Rectum	34 (58.62)	31 (38.75)	2.239	0.0252
<i>Surgery performed</i>				
Radical surgery	48 (82.76)	75 (93.75)	0.320	0.0531
Paliative surgery	8 (13.79)	5 (6.25)	2.400	0.1511
Inoperability	2 (3.45)	0 (0)	7.124	0.1749
<i>Need of stoma</i>				
Yes	28 (48.27)	25 (31.25)	2.053	0.0518
No	30 (51.73)	55 (68.75)	0.487	0.0518
<i>Presence of local invasion</i>				
Yes	26 (44.83)	28 (35)	1.509	0.2901
No	32 (55.17)	52 (65)	0.662	0.2901
<i>Presence of metastasis</i>				
Yes	20 (34.48)	23 (28.75)	1.304	0.5768
No	38 (65.52)	57 (71.25)	0.766	0.5768
<i>Intraoperative blood loss</i>				
Class I Hemorrhage	30 (51.72)	66 (82.5)	0.227	0.0002
Class II Hemorrhage	22 (37.93)	11 (13.75)	3.833	0.0013
Class III Hemorrhage	6 (10.35)	3 (3.75)	2.962	0.1658
Class IV Hemorrhage	0 (0)	0 (0)	-	-
<i>Need of intraoperative blood transfusion</i>				
Yes	24 (41.38)	21 (26.25)	1.983	0.0684
No	34 (58.62)	59 (73.75)	0.504	0.0684
<i>Duration of surgery</i>				
< 90 minutes	7 (12.07)	13 (16.25)	0.707	0.6259 NS
90 - 180 minutes	32 (55.17)	56 (70)	0.527	0.1059 NS
> 180 minutes	19 (32.76)	11 (13.75)	3.056	0.0115

NS - not significant p value

tumor and presence of metastasis resulted no statistically significant differences for the evaluated groups. High intraoperative blood loss (Class II Hemorrhage) resulted in significant statistical parameters regarding the risk of postoperative complications (OR = 3.833, P = 0.0013), while low blood loss (Class I Hemorrhage) seemed to be a protective factor in the development of complications in the postoperative period (OR = 0.227, P = 0.0002). The need of intraoperative blood transfusion had no significant influence on the postopera-

tive evolution in case of both groups. Estimating the duration of surgery, longer operating time was demonstrated as a risk factor for postoperative complications, with an OR = 3.056 and P = 0.0115.

Table 4 presents the results observed while analyzing postoperative and oncologic data. A shorter intensive therapy stay (1-2 days) confirmed to be a protective factor in the appearance of postoperative complications (OR = 0.077, P = 0.0319). Analyzing length of hospital admission resulted shorter

Table 4. Postoperative and oncological data

	Study Group (Group with postoperative complications) n=58 (%)	Control Group (Group without postoperative complications) n=80 (%)	OR (odds ratio)	P value
<i>Intensive therapy care (days)</i>				
1-2 days	14 (24.1)	7 (8.75)	0.077	0.0319
3-4 days	5 (8.6)	0 (0)	3.837	0.5591 NS
> 4 days	7 (12.1)	0 (0)	5.769	0.2994 NS
<i>Length of hospital stay (days)</i>				
Mean	13.06	11.05	-	-
1-7 days	19 (32.76)	41 (51.25)	0.463	0.0373
8-14 days	23 (39.66)	31 (38.75)	1.039	1.0000 NS
> 14 days	16 (27.58)	8 (10)	3.429	0.0113
<i>TNM staging</i>				
Stadium I-II	31 (53.45)	59 (73.75)	0.408	0.0184
Stadium III-IV	27 (46.55)	21 (26.25)	2.447	0.0184

NS - not significant p value

hospital stay (1-7 days) as a significant protective factor against postoperative problems with an OR = 0.463 and P = 0.0373, while a hospital stay above 14 days seemed to be risk factor in the development of complications in the postoperative period (OR = 3.429, P = 0.0113). The statistical analysis of tumor stadium resulted in significant statistical parameters regarding the risk for postoperative complications in colorectal tumors with stage III-IV TNM (OR = 2.447, P = 0.0184). Meantime tumoral stages I-II found to be protective factors in

the development of postoperative issues, with an OR = 0.408 and P = 0.0184.

The possible negative effects of postoperative complications on survival are presented in *Table 5* and *Fig. 1*. For this section of the study patients were regrouped depending on mortality, as mentioned before. Analyzing the established complications, there were found that cardiovascular (OR = 5.727, P = 0.0250), respiratory (OR = 11.762, P = 0.0387) and renal (OR = 4.762, P = 0.0387) complications had the biggest negative impact on the evolution of elder patients.

Table 5. Postoperative complications affecting survival

	DP (Patients with postoperative complications who deceased) n=11 (%)	SP (Patients with postoperative complications who survived) n=47 (%)	OR (odds ratio)	P value
<i>Type of postoperative complication</i>				
Wound infection	0 (0)	2 (4.25)	0.791	1.0000 NS
Intraabdominal abscess	0 (0)	4 (8.51)	0.420	1.0000 NS
Anastomotic leakage	1 (9.09)	3 (6.38)	1.467	1.0000 NS
Bowel occlusion	1 (9.09)	10 (21.28)	0.370	0.6708 NS
Intraabdominal bleeding	4 (36.36)	5 (10.64)	4.800	0.0560
Cardiovascular	7 (63.63)	11 (23.40)	5.727	0.0250
Respiratory	9 (81.82)	13 (27.66)	11.769	0.0015
Renal	5 (45.45)	7 (14.89)	4.762	0.0387
Evisceration	1 (9.09)	2 (4.25)	2.250	0.4745 NS

NS - not significant p value

Figure 1. Percentage of occurred complications and their impact on survival

WI – Wound Infection, IA – Intraabdominal Abscess, AL – Anastomotic Leakage, BO – Bowel Occlusion, IB – Intraoperative bleeding, CV – Cardiovascular, RE – Respiratory, R – Renal, EV - Evisceration

Discussion

Evaluation of Clinical Data and Patients Medical History

The first evaluated aspects were patients clinical data and medical history. While evaluating clinical characteristics of the studied groups, age and gender were the first followed aspects. Mean age was calculated for both groups, with average of 76.87 years for Study Group and 76.65 years in case of Control Group. An increased risk for developing postoperative complications was observed with aging, patients over 76 years old presenting a possible risk factor, these findings being similar to other author's reports (5). During inspection regarding patients gender, there were identified more male patients in the Study group (75.86 %), concluding that male gender is an independent risk factor for the occurrence of postoperative complications. Other authors reported similar results (6). While analyzing patients medical history, we focused mostly on cardiac (arterial hypertension, ischemic cardiomyopathy, heart failure, myocardial infarction, atrial fibrillation), pulmonary (COBP, Asthma, Pulmonary embolism), diabetic (Type I and II), surgical (Surgery for digestive cancer, Other non-cancerous major abdominal surgery) and

obesity related data. There was observed, that obese patients were more likely predisposed for postoperative complications, 34.48 % of patients from Study Group had an increased BMI. Furthermore, heart failure and diabetes type II were identified as independent risk factors in the development of negative postoperative evolution. Statistical analysis of prior surgery for digestive cancer or non-cancerous major abdominal surgery resulted as significant risk factors for unfavorable outcome during the postoperative period. In addition, diabetes type I, chronic pulmonary disease and atrial fibrillation presented increased percentages for developing postoperative complications, being potential risk factors for postoperative issues, however not significant statistically, due to the small number of patients. Similar results regarding the influence of patients medical history, on postoperative outcome, can be found in the literature of specialty (7-13).

Survey of Preoperative Status

In order to avoid or minimize appearance of post-surgical issues, determination of patients general status before colorectal cancer surgery, represents an obligatory step. We evaluated the presence of preoperative anemia, low total protein level, neoadjuvant oncologic therapy

and also ASA score was calculated. While examining the presence of neoadjuvant oncologic treatment, there was noticed that a higher percentage of patients benefited of radiotherapy (SG – 12.79%, CG – 8.75%), while chemotherapy was applied in 10.34 % in case of SG and only 2.5 % for CG, without statistical significance in case of both groups. However, an increased OR for postoperative complications was remarked for patients from Study Group. Similar aspects can be found in other surgical articles to (14). Investigating preoperative anemia concluded that majority of patients from Study Group presented moderate or severe anemia (Moderate Anemia 37.93 %, Severe Anemia 22.41 %), while in case of patients from Control Group anemia at the time of hospital admission was present in lower percentages. Based on the related, there can be stated that preoperative severe anemia increased the risk for appearance of postoperative complications, while mild anemia confirmed to be a protective factor in the development of negative postoperative evolution. Others reported close results to ours (15). Analyzing total protein level, there can be observed that almost half of patients (48.27 %) who presented complications in the postoperative period had lower levels of total protein. Therefore, low total protein level at the time of hospital admission was identified as a significant risk factor for postoperative complications. Comparable results can be found in the literature of specialty (16). There was also noticed that ASA I-II stages were identified as protective factors, while more advanced stages of ASA classifications (III-IV) were recognized as independent risk factors for developing postoperative complications. Close results to ours can be found in similar articles (17,18).

Analysis of Surgical Details

While inspecting surgical assessment, nature of surgical intervention was the first aspect to follow. There were observed a majority of elective surgeries for both of the studied groups, aspect which confirmed to be a protective factor against the appearance of post-

operative complications. In case of Study Group, 36.21 % of patients were admitted in emergency condition and benefitted of immediate surgical care, while in case of Control Group, only 17.5 % of patients presented at the emergency unit. However, surgery in emergency surroundings resulted to be an independent risk factor for developing postoperative problems. Other authors reported same results to ours (19). The majority of tumors were localized in the distal part of large bowel and the rectum. Analyzing these data resulted rectal localization being a statistically significant risk factor for potential poor postoperative outcome. There can be found close result to ours (20). Performed surgery was also investigated, focusing on the character of practiced interventions, whether it was a radical operation, just palliative surgery or inoperability forced the surgeons to abort any surgical treatment. Among operations, radical surgery was performed in the highest percentage. Patients who benefited of palliative surgery or inoperability was diagnosed, presented an increased possibility for postoperative complications. Surprisingly, patients who underwent radical surgical intervention seemed to be associated with a decreased incidence of postoperative complications, likely due to the small number of patients. Aspect, which is contrary with the literature of specialty (21). The influence of protective or permanent stoma on the appearance of postoperative complications was also analyzed, observing an increased possibility for postoperative problems in case of patients with stomas, however, no statistical difference was observed for both of the studied groups. Analyzing local invasion of the tumor or presence of metastasis were not associated with any influence on the development of postoperative complications. The assessment of intraoperative blood loss showed an increased risk for developing postoperative complications for patients with increased bleeding during surgical intervention (Class II and III Hemorrhage), while less quantity of blood loss (Class I Hemorrhage) confirmed to be a protective factor in the occurrence of postoperative complications. Other authors report

the same results (22). The necessity of intraoperative blood transfusion displayed a potential risk for possible negative postoperative evolution, but not significant from statistical point of view, probably due to the small number of patients. However, other authors stated the same (23). Operating time is well known to contribute to patients postoperative evaluation and prognosis. While analyzing operating time during the present study, there was observed a negative influence on postoperative outcome for patients with prolonged surgical intervention. Close results with ours can be found in the literature of specialty (24).

Postoperative Data

Postoperative assessment investigated the potential involvement of the intensive therapy abidance, length of hospital stay and tumoral stages in the occurrence of postoperative complications in studied patients. As there was expected, a favorable postoperative outcome was identified in case of patients with minimal intensive therapy stay, while extended necessity of intensive unite therapy was determined as a possible risk factor for postoperative obstacles, although statistically not significant due to the reduced number of patients. Results close to ours can be found in similar articles (25). Average length of hospital stay was higher for patients from Study Group, representing a mean of 13 days. We also observed, that reduced hospital stay had a favorable influence on patients, regarding the occurrence of postoperative complications. Although not significant from statistical point of view, but prolonged hospital stay was identified as a possible risk factor for negative postoperative events. Same result can be found in similar articles (26). Tumoral staging (TNM) had itself influence on the postoperative outcome of patients, incipient stages of malignant tumors (Stage I-II) confirmed to be a protective factor in the development of postoperative complications. Patients who were suffering from advanced stages of cancer, presented in higher percentage postoperative complications, proving that stages III-IV of

cancer are significant risk factors for negative postoperative outcome. Similar effects can be red in major surgical articles (27).

Occurred Complications During Hospital Stay

During the study there were identified multiple types of complications during the postoperative period, which influenced the outcome of elderly patients. Colorectal operations are contaminated procedures, in many cases peritoneal cavity and wound surfaces contamination happens. In the present study 4.25 % of patients presented wound infections. Antibiotic prophylaxis plays a major role in preventing these types of complications. Intraabdominal abscess occurred in 8.51 % of patients, making reoperation and an effective drainage necessary. Appearance of anastomotic leakage still remains one of the most feared complications possible of digestive cancer surgery, leading to peritonitis and in some cases to abdominal compartment syndrome, presenting a significant negative influence on patients survival. Early decision of reoperation should be made if necessary, in order to improve patients outcome (28). Occurrence of bowel occlusion prolongs hospital stay and increases morbidity of patients. Treatment is sometimes difficult, early diagnosis and proper surgical care has major benefits in patients evolution. Evisceration occurred only in three cases, without an important influence on postoperative mortality, although it represents a serious condition, which needs special attention and careful treatment. According to the present study, intraabdominal bleeding, cardiovascular, respiratory and renal complications were the most frequent and feared postoperative issues occurred after colorectal surgery, with negative influence on the survival of elderly patients. Generally postoperative intraabdominal bleeding is a rare condition and depends mostly on the surgical procedure performed. Accurate postoperative follow up can highlight abnormal heart rate, low blood pressure and modified Hemoglobin, Hematocrit values. Preoperative careful selection of patients could spotlight

underlying cardiovascular disease. Patients early mobilization could avoid appearance of pneumonia, proper anticoagulant prophylaxis can rule out blood clotting and embolization. As a summary, the overall complication rate was 42.02 %, while mortality represented 7.97 % and was statistically significant in favor of patients who presented post-operative complications. Aspects stated before can be found in multiple studies (28-33).

Short-Term Postoperative Complications Affecting Survival

For the last section of the study, patients were regrouped as follows: Patients with postoperative complications who deceased (DP) and Patients with postoperative complications who survived (SP), willing to prove the influence of postoperative complications on the prognosis of studied patients. There was observed, that patients who developed complications during the postoperative period, were exposed to high risk for decease in relation to patients without postoperative complications. Other published reports being similar to our findings (34,35).

Conclusion

The surgical treatment of colorectal cancer in the aging population still remains a challenge, which has got its own characteristics. The outcomes of colorectal surgery in geriatric patients is uncertain, occurred postoperative complications increase the morbidity and mortality rates. Proper surgical treatment of these category of patients requires an optimal knowledge of the factors influencing the outcome of surgical procedures. Based on the presented study we believe, that management of CRC in elderly patients requires a careful approach and a personalized strategy for treatment. In the preoperative period an optimal risk assessment is necessary in order to exclude patients from surgery based on the morbidity, or to determine the required pre-operative care adjusted to the patient's clinical

Table 6. Summary – Identified risk factors

No	Risk factors for developing postoperative complications in elderly patients with colorectal cancer
1	Male Gender
2	Obesity
3	Heart Failure
4	Diabetes Type II
5	Severe Anemia
6	Low Total Protein Level
7	ASA III-IV Classification
8	Emergency Surgery
9	Prolonged Surgery
10	Increased Intraoperative Blood Loss
11	Longer Hospital Stay
12	Distal Localization of Tumor
13	TNM Stages III-IV of Tumor
14	Surgery for Digestive Cancer in Medical History
15	Other Non-Cancerous Major Abdominal Surgery in Medical History

and physical status. Furthermore, a proper evaluation of preoperative nutritional and cardiopulmonary status has got a major importance to avoid possible negative post-operative evolution. In all cases accent should be put on prevention, early identification, and avoiding of perioperative complications. For patients with considerable comorbidities, a multidisciplinary approach may be chosen in order to optimize the preoperative condition and also to prevent development of postoperative complications. Elderly patients suffering from postoperative complications after colorectal surgery should benefit of special attention in order to offer the best chance for survival. In order to ensure a chance to minimize or avoid these complications it is crucial to know the major risk factors, based on which surgeons can work out different strategies to prevent or reduce the negative influence of postoperative complications. Major risk factors which influence postoperative complication rate are summarized in *Table 6*.

For performing this study ethical approval was obtained.

Conflict of Interest

The authors declare no conflicts of interests.

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