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ORIGINAL ARTICLE / ОРИГИНАЛНИ РАД

The importance of laparoscopic surgery for early postoperative course in patients with colorectal carcinoma

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SUMMARY

Introduction/Objective The aim of our study was to compare early postoperative recovery in patients operated on using laparoscopically assisted and open method in colorectal carcinoma surgery.

Methods The study involved 60 patients, divided into two groups of 30 patients each, treated with open or laparoscopically assisted colorectal surgery. Three groups of factors were collected and analyzed for all the patients. The first group of factors were as follows: age, sex, the American Society of Anesthesiologists score, preoperative hemoglobin, localization. The second group of factors were the following: intraoperative complications, the duration of operations, blood and blood derivatives' compensation. The third group were as follows: complications, length of stay in intensive care, rate of peristaltic establishment, and the time needed for unobstructed oral intake, number of hospitalization days, analgesic use, and verticalization time.

Results The patients who underwent laparoscopically assisted surgery showed significant advantages in the early postoperative recovery compared with those who underwent open surgery, in terms of the number of postoperative days of hospitalization ($p < 0.001$), the duration of the operation ($p < 0.001$), the day of establishment of peristalsis ($p = 0.009$), and the day of establishment of unobstructed oral intake ($p < 0.001$), the time of verticalization of the patients ($p = 0.001$), the use of analgesics ($p < 0.001$).

Conclusion Laparoscopically assisted surgery has an advantage over open surgery colorectal cancer, as regards of early postoperative recovery of the patient.

Keywords: laparoscopic colorectal surgery; open colorectal surgery; colorectal cancer

INTRODUCTION

Colorectal cancer is the third most common cancer in men (746,000 patients per year, 10% of total cancer patients) and the second most prevalent cancer in women (614,000 patients per year, 9.2% of total cancer patients). It is represented in 8.5% of all patients with malignant tumors in the world [1]. With continuous improvement of modern medicine and technology, the aims are set to faster recovery time, as well as the reduction of postoperative morbidity and mortality.

Laparoscopic colorectal surgery has been routinely performed by the surgeons of the Department for General Surgery, Zemun Clinical Hospital Center since 2013. The aim of our study was to compare early postoperative recovery in patients treated with laparoscopically assisted and classical, open method in colorectal cancer surgery.

METHODS

The study was performed as a clinical retrospective study. It included 60 patients who underwent elective laparoscopically assisted or open colorectal surgery at the Clinic for Surgery, Zemun Clinical Hospital Center in Belgrade from January 2013 to September 2016. The study involved 60 patients with acceptable general operability and diagnostically verified malignant colorectal neoplasm. The patients were divided into two groups, each of 30 patients: the first group was composed of patients treated with open colorectal surgery; the second group were patients undergoing laparoscopically assisted colorectal surgery.

Three groups of factors were analyzed for all patients. The first group of factors was known preoperatively: age, sex, American Society of Anesthesiologists (ASA) score, preoperative values of hemoglobin, and localization. The second group of factors was known intraoperatively: we analyzed the potential differences of intraoperative complications, the duration of operations, blood and blood derivatives' compensation. The third group of factors were known postoperatively: complications, length of stay in intensive care, rate of peristaltic establishment and the time needed for unobstructed oral intake, number of hospitalization days, analgesic use, and verticalization time. The criteria for patient involvement in the study for both groups were as follows: patients with

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histopathologically diagnosed colorectal cancer, both sexes, age over 18 years, acceptable general operability, written consent for operative treatment.

Indications for surgical treatment were based on the guidelines issued by the Society of American Gastrointestinal and Endoscopic Surgeons [2]. Preoperatively, all the patients were prepared in terms of complete diagnostics for the diagnosis of colorectal malignancies. Colonoscopy was performed with biopsy and pathohistological analysis of the material, analysis of blood count and biochemistry, blood group, followed by supplementary diagnostic methods in the form of multi-slice computed tomography / magnetic resonance imaging of the abdomen and the pelvis, X-ray of the chest, due to preoperative determination of disease stage. Immediately the day before surgery, the patients discontinued oral administration, fluid reimbursement by infusion was administered in the form of solutions 0.9% NaCL, Ringer's lactate solution, Hartmann's solution, or 5% glucose solution. The patients were preoperatively administered an antibiotic in the form of second- and third-generation cephalosporins and metronidazole, as well as mandatory thromboembolic prophylaxis. The patients were operated on according to the regular operating program – electively in general endotracheal anesthesia. The following details of the surgical procedure were recorded in all the patients: duration of operation, amount of homologous blood transfused. Transfusion of blood products in the perioperative period was based on the hemoglobin level of 80 g/L or on an individual basis according to the clinical condition. All the patients were treated in accordance with a strictly controlled protocol with regard to analgesic administration, feeding, and postoperative care. Postoperative recovery of the bowel function was evaluated by first flatus and bowel movement. Postoperatively, the patients were transferred to the intensive care unit and then transferred to the Department of General Surgery as needed. Any anastomotic dehiscence with clinical and/or radiologic evidence was considered. The patients were discharged after meeting the following conditions: bowel movement and full recovery of both ambulation and oral food intake. Follow-up for infectious and noninfectious complications was carried out for 30 days after hospital discharge by weekly office visits.

The data required for this study were taken from the protocol of surgical treatment, patient medical history, therapy list of the patients, anesthesiology lists conducting surgical treatment and pathologist reports. All the data was grouped into two tables, which were subsequently used for statistical processing. The first table presented patients operated on by open surgical technique, while the second one showed patients operated on by a laparoscopically assisted surgical technique.

Descriptive and analytical statistical methods were used in this study. Of the descriptive ones used were the following: absolute and relative numbers (n, %), measures of central tendency (arithmetic mean, median), dispersion measures (standard deviation, interval of variation). Of the analytical statistical methods, the difference tests were used: parametric (t-test), non-parametric (χ^2 test, Fisher's exact probability test, Mann–Whitney U-test).

The choice of test depended on the data type and distribution. Parametric methods were used in situations where the distribution was normal, while non-parametric ones were used in situations where the distribution is not normal. The normality of the distribution was examined on the basis of descriptive parameters, normality distribution tests (Kolmogorov–Smirnov and Shapiro–Wilk test) and graphical methods (histogram, boxplot, QQ plot). The results are presented in tables and graphs. All the data were processed in IBM SPSS Statistics for Windows, Version 20.0 (IBM Corp., Armonk, NY, USA).

The study was done in accordance with the standards of the institutional committee on ethics.

RESULTS

The mean age of the patients was 67.5 years. The oldest patient in both groups was 86 years old, while the youngest one was 25 years old and underwent open surgery.

There was no statistically significant difference between the groups ($t = -0.697$; $p = 0.489$).

In the laparoscopic group of patients, 14 men and 16 women were represented. In the open patient group, 19 men and 11 women were represented. There was no statistically significant difference between the groups ($\chi^2 = 1.684$; $p = 0.194$). The third group of the ASA score patients was the highest in both groups, in as much as 68%. There was no statistically significant difference between the groups ($Z = -1.695$; $p = 0.090$). The mean hemoglobin in both groups was 126. There was no statistically significant difference between the groups ($t = 0.050$; $p = 0.960$). In the laparoscopic group, the largest percentage of malignancy was present in the region of sigmoid colon with 36.7%, while in the open surgery group the largest percentage of malignancy was in the area of the proximal third of the rectum with 43.3%. In the laparoscopic group the rectum was represented in 36%. All the patients had a diagnosed colorectal adenocarcinoma.

In the intraoperative group of factors, there were no significant intraoperative complications of the examined patient groups such as abundant abdominal bleeding and intraoperative lesions of the surrounding organs. The average operative time in the open group was 120 minutes, while in the laparoscopic group it was 156 minutes. The duration of the laparoscopic surgery is statistically significantly longer than open surgery group ($t = -4.783$; $p < 0.001$) (Table 1).

In the open group, blood transfusion was administered in nine patients. In the laparoscopic group, blood transfusion was administered in 10 patients. Intraoperatively, one dose of blood was administered in two patients in the laparoscopic group, while in the open group two patients were administered one dose of blood and one patient was administered two doses of blood. Postoperatively, in the laparoscopic group, four patients were administered one dose of blood each, and three patients two doses of blood. In the open group, two patients were administered a single dose of blood, three patients two doses of blood. There was

Table 1. Intraoperative factors in analyzed groups

Intraoperative factors	Open group (n = 30)	Laparoscopic group (n = 30)	p
Operative time (minutes)	120	156	< 0.001
Complications Organ injury Massive hemorrhage	/	/	/
Blood transfusion one dose two doses	2 1	2	0.781

Table 2. Postoperative complications in analyzed groups

Complications postoperative	Open group (n = 30)	Laparoscopic group (n = 30)	p
Lethal outcome	1	2	1.000
Anastomotic dehisces	3	2	
Intraabdominal hemorrhage	0	2	
Subcutaneous emphysema	0	1	
Wound infection	1	0	
Necrotizing fasciitis	0	1	
Clostridium difficult-colitis	1	0	
Urinary retention	2	1	

Table 3. Postoperative factors in analyzed groups

Postoperative factors	Open group (n = 30)	Laparoscopic group (n = 30)	p
ICU stay (days)	1.93	1.77	0.143
Peristalsis (days)	2.47	1.9	0.009
Oral intake (days)	3	2	< 0.001
Blood transfusion one dose two doses	4 3	2 3	0.781
Hospitalization (days)	9	5	< 0.001
Analgesics First degree Second degree	20 2.72	12 < 1	< 0.001 < 0.001
Verticalization (days)	2.9	1.9	0.001

no statistically significant difference ($\chi^2 = 0.077$; p = 0.781) (Table 2).

In the second group of factors, by analyzing postoperative complications in the two observed groups, there were no statistically significant differences between the groups ($\chi^2 = 0$; p = 1.000). There were two lethal outcomes in the laparoscopic group and one in the open group. Two patients in the laparoscopic group and three patients in the open group had anastomosis dehiscence ($\chi^2 = 0.218$; p = 1.000). In the laparoscopic group of patients, both dehiscences were treated by reoperation. One dehiscence in patients of the laparoscopic group was due to increased bleeding from stapler anastomosis. In the open group, two dehiscences were treated by reoperation, while one was treated conservatively. Postoperative intraabdominal hemorrhage was verified in the laparoscopic group of patients. In one case it was treated conservatively, while in another it was treated by reoperation. In the laparoscopic group, subcutaneous emphysema was verified in one patient and was spontaneously resolved. In the open group one patient had wound infection, there was one dehiscence of the wound, which were treated with suture. In the laparoscopic group of patients, a complication of necrotizing fasciitis was verified, which led to a lethal outcome. Clostridial intestinal infection in the form of pseudomembranous colitis was verified in one patient in the open group.

Two urinary retention rates were verified in the open and one in the laparoscopic group of patients (Table 3).

There was no statistically significant difference between the groups in length of stay in the intensive care unit (Z = -1.466; p = 0.143). There was, however, a statistically not significant difference: patients in the laparoscopic group averaged 1.77 days in the intensive care unit, while the patients of the open group averaged 1.93 days. A statistically significant (Z = -2.630; p = 0.009) earlier establishment of peristalsis was in a group of patients operated on laparoscopically. Peristalsis was established in 1.93 days on average in the laparoscopic group, while in the open group the average value was 2.47 days. There was a statistically significant difference in the rate of establishing undisturbed oral intake (Z = - 4.399; p < 0.001) – the average for the laparoscopic group was the second postoperative day, while for the open group it was the third postoperative day. In the laparoscopic group, an unhindered oral intake was established in seven patients on the first postoperative day, while in the open group of patients unhindered oral intake was not established before the second postoperative day. On average, the patients of both groups passed stool after the fourth postoperative day (Z = -0.811; p = 0.418). Postoperatively, the patients of the laparoscopic group were hospitalized for a statistically significantly (Z = -4.607; p < 0.001) shorter length of time (five days on average) in comparison to the patients of the open group (nine days on average).

The average number of doses of the first-degree analgesics administered to the patients of the laparoscopic group was12, while averagely 20 doses were administered to the patients undergoing open surgery. Less than one dose of the second-degree analgesics was administered in the laparoscopic group of patients, and an average of 2.72 analgesics were administered in the open group. Analgesics of the first (Z = -3.896; p < 0.001) and the second degree (Z = -2.303; p = 0.021) were statistically significantly less ordained in the laparoscopic group of patients than in the open group of patients. We found a statistically significant difference (Z = -3.341; p = 0.001) per patient verticalization day. Patients of the laparoscopic group were verticalized one day earlier on average than those of the open group. In the laparoscopic group, the patients were verticalized after 2.9 days on average, whereas in the open group this took place after 3.9 days on average. The earliest verticalization in the patients of the laparoscopic group was on the first postoperative day, while in the open group it was on the second postoperative day.

DISCUSSION

Following the introduction of laparoscopic cholecystectomy and its success in the treatment of gallbladder disease,

laparoscopic surgery began to be applied in other fields as well. Open colorectal cancer surgery has been considered the gold standard for surgical treatment of this disease for decades. With the advancement of technology and modern medicine, minimally invasive surgery is becoming the next step in the treatment of this disease. With the advent of laparoscopic procedures in the treatment of colorectal cancer, numerous papers on this topic have been published. They have showed an improvement in the quality of operative technique, and especially an advantage in the early postoperative recovery after this type of operative treatment [3, 4, 5]. At the very beginning, laparoscopically assisted colorectal surgery appeared promising and studies were done that confirmed that this type of surgery was less traumatic than open surgery. Leung et al. [6] in their study examined the systemic response of cytokines after laparoscopically assisted and classic resections of rectosigmoid carcinoma in 34 patients. Their results showed that trauma of the tissue, which is reflected in the cytokine response, is smaller after laparoscopic surgery. Theoretical advantage of colorectal cancer laparoscopic surgery over classic surgery is less painful operative wounds, and therefore less use of analgesics, earlier recovery of both bowel function and oral feeding, lower percentage infections of the surgical wounds, faster mobilization and shorter hospitalization of patients. Numerous studies have been done and some are ongoing, examining whether laparoscopic surgery has surpassed open surgery and whether it is able to fulfil adequately oncological radicality, which is of paramount importance [6, 7, 8].

In this study, the objective benefit of early postoperative recovery was evaluated in patients treated with laparoscopic surgery compared to those treated with classical colorectal surgery. We compared preoperative parameters between these two groups of patients, to show homogeneity in patient choice for both procedures. The mean age of the patients was 67.5 years. Regarding some studies that dealt with comparison of laparoscopic and open colorectal surgery, we can see benefits in patients over 70 years old treated with laparoscopic surgery, which shows a lower rate of postoperative mortality and morbidity. For elderly patients, of great importance is early mobilization, which is faster established in patients operated on by laparoscopic surgery [9, 10]. In several studies that analyzed risk factors for laparoscopic conversion colorectal surgery, one of the factors that proved statistically significant was obese male sex [11, 12]. The third group of ASA patients had the highest prevalence in both groups, in as much as 68%. A multicenter randomized Medical Research Council Conventional versus Laparoscopic-Assisted Surgery in Colorectal Cancer study concluded that the risk of conversion laparoscopic colorectal to open surgery rises in patients with ASA score of over 3 [13]. The ASA score is also an elevated independent predictor of postoperative mortality and morbidity [14]. Preoperative anemia is associated with poorer cancer response to therapy, poorer locoregional disease control, and overall shorter patient survival [14, 15]. The intraoperative and postoperative parameters that we compared showed a number of similarities with world studies done on this topic. In this study, there is a statistically significant difference in the operating time. The shorter operating time was in open surgery. We find similar data in a number of randomized studies, but conclusion of these studies is that laparoscopic colectomies are associated with improved outcomes compared with open operations that do not exceed an operative time of six hours. [16, 17]. The average operating time in the open group was 120 minutes, while it was 156 minutes in the laparoscopic group. We did not find significant difference between the duration of laparoscopic surgery when comparing our study to others. Nelson et al. [17] in their study involving 435 laparoscopic colorectal operations had an average operating time of 150 minutes. However, numerous studies indicate that continuous training of teams which are dealing with laparoscopic colorectal surgery, after multiple operations, reduces the duration of the operation [18, 19]. Hence, we can expect these two types of surgical treatment's duration to approximately equalize. In terms of reimbursement of blood and blood derivatives, we compared intraoperative and postoperative administrations of these products. The result of our research is that we did not obtain statistically significant difference in the ratio of the study groups. Our results coincide with a large meta-analysis by Japanese authors, who compared 12 papers – randomized studies – by comparing laparoscopic and classic colorectal surgery 1990–2011. This study included 4458 patients, which also showed no statistically significant difference in the reimbursement of blood transfusion [20]. It is considered that the advantage of laparoscopic surgery is the optical magnification of the operative fields, making the operational field, substrate, and surrounding structures more transparent. This fact should be in favor of lower intraoperative blood loss, and therefore reduced intraoperative and postoperative blood supply, which is confirmed by some papers [21]. Regarding intraoperative and postoperative complication, there was no statistical difference. This result show that laparoscopic colorectal surgery is as safe as open surgery. There is a difference, not statistically significant, in stay in the intensive care unit. Patients in the laparoscopic group spent 1.77 days in the intensive care unit, while patients in the open group spent 1.93 days there. A statistically significant difference was verified regarding the number of postoperative days hospitalized. We can agree with most studies that speak in favor of shorter postoperative hospitalization in patients operated on using laparoscopic surgery [22, 23]. The mean length of hospital stay in the laparoscopic group was five days. Similar results are shown in the study conducted by Lacy et al. [24], where average hospital stay was 5.2 days. Compared to some other randomized studies, our study differs from the study by Braga et al. [25], according to which the mean length of hospital stay was seven days for colon and 10 days for rectum, and from the COLOR study, where patients were averagely hospitalized 8.2 days [23]. By comparing the recovery of the bowel function and the recovery of oral food intake we found a statistically significant difference between the two groups, as some of the advantages of laparoscopic surgery are precisely in these two categories. Peristalsis was established in the laparoscopic group after 1.93 days, while in the open group it was established after 2.47 days. In a

study by Koh et al. [26], the recovery of the bowel function in the laparoscopic group is after 2.57 days. The COLOR II study has a slightly different results, with 1103 patients operated on laparoscopically, recovery of the bowel function was on the second day [27]. In our study, unobstructed oral intake was established on the second postoperative day on average in the laparoscopic group, while in the open group it was established on the third postoperative day. In the laparoscopic group, recovery of oral food intake on the first postoperative day was established in seven patients, while in the open group it was not established before the second postoperative day. The time of recovery of oral food intake in the study by Lacy et al. [24] was established on the second day, while it was almost on the third day in the COLOR study [23]. In the laparoscopic group, the patients were verticalized on average after 2.9 days, while in the open group this averaged 3.9 days. Most studies that compare laparoscopically assisted and classic colorectal cancer surgery support our results [23, 25, 26, 27]. As most other studies, we tried to express the degree of pain in patients through dose quantity of an administered analgesic. Pain management after colorectal surgery varies widely and predicts significant differences in patient-reported pain and clinical outcomes. Enhanced postoperative pain management requires dissemination of multimodal analgesia practices [28]. In our study, the analgesics we used were divided into the following two groups: first-degree analgesics – non-opioid analgesics (metamizole-sodium, ketorolac, diclofenac), and second-degree analgesics – opioid analgesics (tramadol). Studies showed a statistically significant difference in the administration of second-degree analgesics in terms of less administration of the analgesics in laparoscopic colorectal surgery.

CONCLUSION

Laparoscopically assisted surgery has an advantage over classical surgery colorectal cancer in regard to early postoperative recovery of the patient.

Conflict of interest: None declared.

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Значај лапароскопске хирургије за рани постоперативни ток болесника са колоректалним карциномом

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САЖЕТАК

Увод/Циљ Циљ наше студије био је поређење раног постоперативног опоравка код болесника оперисаних лапароскопски асистираном и отвореном методом код преоперативно хистопатолошки дијагностикованог колоректалног карцинома.

Методе У истраживању је учествовало 60 болесника са колоректалним карциномом, који су подељени у две групе од 30 болесника лечених отвореним или лапароскопским путем. Три групе фактора су прикупљене и анализиране за све болеснике. Прва група фактора били су старост, пол, *ASA* оцена, преоперативни хемоглобин, локализација тумора. Друга група параметара су интраоперативне компликације, трајање операције, надокнада крви и крвних деривата. Трећа група параметара били су постоперативне компликације, дужина боравка на интензивној нези, време отпочињања перисталтике и пероралног уноса, дужина хоспитализације, употреба аналгетика и време вертикализације.

Резултати Болесници који су били подвргнути лапароскопским операцијама показали су значајне предности у раном постоперативном опоравку у поређењу с онима који су били подвргнути отвореној операцији, у погледу броја постоперативних дана хоспитализације ($p < 0,001$), трајања операције ($p < 0,001$), дана успостављања перисталтике ($p = 0,009$) и дана успостављања несметаног оралног уноса ($p < 0,001$), време вертикације болесника ($p = 0,001$) и употребе аналгетика ($p < 0,001$).

Закључак На основу наших резултата може се закључити да лапароскопска хирургија карцинома колоректума има предност у односу на отворени оперативни приступ, што се тиче раног постоперативног опоравка болесника.

Кључне речи: лапароскопска колоректална хирургија; отворена колоректална хирургија; колоректални карцином