

# Laparoscopic Colon Surgery: Our Results

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## ABSTRACT

*Formerly, the laparoscopic surgery was accepted as a method of choice for benign diseases, and for palliative operations in progressive stages of malignant diseases of the colon. Today, the laparoscopic surgery of the colon has been also adopted in treating malignant diseases. The first laparoscopic colon resection was performed in our Clinic on December 12, 2002, and 114 patients have been successfully operated until June 1, 2007. Among those 114 patients 56 were men and 57 were women with the average age 65 (ranging from 28–86) years. A series of various laparoscopic operations have been performed for malignant disease mainly (almost 80%). The pre-surgical treatment, preparation of patients and the types of the operations were identical to those applied in patients treated by open surgery. Patients with colon carcinoma have been operated on with the principles of oncologic radicality. In post-operative period we encountered eight complications (four minor and four major) with only one fatal outcome. According to our experience and the facts found in literature, the results of laparoscopic colon surgery are comparable with open surgery.*

**Key words:** laparoscopic surgery, colon, learning curve

## Introduction

Laparoscopic operations of the colon are comparable to those of the open surgery. If we compare mortality rates between laparoscopic and open surgery result are similar, whereas the recurrence rate of the disease following laparoscopic operations appears lower (7–31.1%), while in open surgery it ranges between 15 and 31.3%<sup>1–4</sup>. Also, in malignant diseases of the colon, a long-term survival period may be even longer after a laparoscopic surgery, which depends on the disease stage<sup>5–10</sup>. In the early stage of implementation of the laparoscopic surgical technique in treating malignant tumours, most objections were related to the probable port site metastasis and at the place of the specimen removal. However, various authors have recently reported on comparability of the incidence of such metastasis to that of metastasis in surgical scars subsequent to open surgery, under 1%, after adequate precautions<sup>11–14</sup>. Finally, these and similar facts have contributed for the laparoscopic surgery on the colon and rectum to be looked upon as of a curing technique of an equal quality, if not even superior, as compared to that based on open surgery.

As it has been the case with the laparoscopic surgery of the hernia, the laparoscopic surgery of the colon is of-

ten considered considerably costlier and as the one requiring a longer period of time to be completed. However, these issues depend on the experience of the surgeon and of the team. Completing an adequate educational training and accomplishing the learning curve may contribute, considerably, for a laparoscopic operation to have a shorter duration. Furthermore, taking into consideration the advantages of the laparoscopic technique, as well as on account of a shorter post-surgical recovery period for the patient, the cost are not necessarily higher<sup>15</sup>. The blood consumption in laparoscopic surgery is lower as compared to other techniques, too.

Upon the implementation of an adequate educational procedure, the practice of the surgical techniques, as described above, was started more than two years ago, whereas the first laparoscopic colon resection of a malignant tumour was carried out on December 12, 2002. The initial results and observations in laparoscopic colon surgery, along with the details related to the rate of survival period for the patients treated by the laparoscopic technique for colon carcinoma, are presented hereinafter.

## Patients and Methods

The study included data on 136 patients laparoscopically treated at University Department of Surgery, Split University hospital, from December 12, 2002 until June 1, 2007. From total number of 136 patients at 114 of them (83.8%) operation was completed laparoscopically. Among those 114 patients 56 were men and 57 were women, with the average age of 65 (ranging from 28–86) years.

The reasons of not completing operation laparoscopically are listed in Table 2 and those patients are not included in further analysis in this paper.

The pre-surgical treatment, preparation of patients and the types of the operations were identical to those applied in patients treated by open surgery. In addition to the conventional pre-surgical examinations, all patients were subjected to barium enema and/or colonoscopy with biopsy, as well as to an ultrasonic examination of the abdomen. For patients with malignant tumours, a computer tomography (CT) of the abdomen was also provided, along with the analysis of the level of tumour markers. In order to define, with precision, the location of pathological changes (alterations), as well as to elaborate a plan for the operation, as accurately as possible, a barium enema is recommended, even if subsequent to a complete colonoscopy, due to the fact that the possibility for an intra-operative examination of the entire colon is almost impossible in laparoscopic surgery. Furthermore, the need of a detailed examination of the parenchymal organs is particularly indicated before a laparoscopic operation. It is of particular importance, to define by measuring, prior to the operation and with precision, the distance between the alterations in the rectum and the ano-cutaneous border. As a rule, the surgeon in charge performs rectoscopy before the operation.

In the immediate pre-surgical preparatory procedure, our patients are given a mechanical rectum cleansing with enema. In the morning preceding the surgery, an initial dose of the low-molecular weight heparin, as well as a blockader of H<sub>2</sub> receptors (ranitidine) and a single dose of antibiotics (metronidazole and cephalosporin) were administered in all cases. A urinary catheter was placed immediately before the operation, and the nasogastric tube was not placed routinely.

The degree of inclination of the patient's position, in the course of operation, depended on the location of the disease, and it was modified as required in different stages of operation. The pneumoperitoneum, with a 12 mmHg pressure, was achieved mainly by means of a Veress needle in all cases, with the exception of the patients who had previously been subjected to the operations on the abdomen. Under such circumstances, placing of the first trocar is done by open technique.

Subsequent to an adequate laparoscopic exploration, as well as upon the identification of alterations, in the cases where a malignant tumour was concerned the colon was approached applying a »no touch« technique. In compliance with our regular practice when the open sur-

gery is concerned, the colon was mobilized from the lateral direction towards the medial area. We used a Harmonic scalpel 5mm shears (Ultracision; Ethicon Endo-Surgery, Inc., Cincinnati, Ohio, USA), 10 mm (LaparoSonic Coagulation Shears, LCS6S or LCS15; Ethicon Endo-Surgery) and bipolar coagulation (Ligasure, Tyco-Healthcare). In malignant diseases, and in patients where the operation was performed with the prospective of a complete cure, the so-called »high arterial ligation« was provided, along with the cutting of vascular structures.

During the operation on the left or the sigmoid colon, the display of the left ureter was pursued. If, through a preparation procedure it was possible to obtain a successful display of a blood vessel isolated in the vascular stem, a number of endoscopic titanium clips was used for ligation. In default of the described circumstances, the support of the vascular stem was effected by means of an endoscopic cutter, containing white vascular filling (Endopath ETS, Flex 45 Endoscopic Cutter; or Eschelon 60; Ethicon Endo-Surgery). In carrying out the low resections of the left colon and/or the sigmoid large intestine, the bowel was cut with an endoscopic cutter with a blue intestinal filling (Endopath ETS Flex 45 Endoscopic Cutter, or Eschelon 60; Ethicon Endo-Surgery). In order to remove the resected part, a transversal or longitudinal suprapubic incision was done in operations on the sigmoid and/or left colon, as well as in cases of subtotal colectomy, whereas a right subcostal, right transrectal or upper medial incision was applied in the case of a right colon resection.

Anastomoses were performed manually or by staplers. Typical manual single-layer anastomoses were practised in the resection of the left and right hemicolectomies. In low sigmoid and rectum resections, the »double stapler« technique was applied for anastomoses, where a circular stapler was used (Proximate ILS, CDH, Ethicon Endo Surgery). Contact rubber drainage was routinely used, except after laparoscopic colostomy.

Laparoscopic bipolar colostomies were performed on the sigmoid or transversal large intestine over a »rider«.

## Results

Due to the diversity of operations and a small number of the patients with the same operation an overall report on the results obtained is not completely feasible. Furthermore, for the same reasons the follow-up is short, so it is not possible to present the survival curves following our laparoscopic resections.

In general, the resection laparoscopic interventions had a somewhat longer duration, whereas the colostomy operations required a similar or a shorter period of time in comparison to those done by the open surgery technique. The list of operation is presented in the Table 1. The average duration of the resection surgery in our patients was 132.33 (ranging from 45–350, SD ± 29.5) minutes. The longest operations were subtotal colectomies with mean operative time of 215,83 minutes and the

**TABLE 1**  
LIST OF OPERATIONS

| Operation performed                                  | Number of patients |
|--|--------------------|
| Resectio recti anterior sec. Dixon per laparoscopiam | 33                 |
| Colostomia bipolaris per laparoscopiam               | 20                 |
| Hemicolectomia lat. dex. per laparoscopiam           | 18                 |
| Resectio sigmae per laparoscopiam                    | 13                 |
| Amputatio recti per laparoscopiam                    | 6                  |
| Colectomia subtotalis per laparoscopiam              | 6                  |
| Coecectomia partialis per laparoscopiam              | 5                  |
| Hemicolectomia lat. sin. per laparoscopiam           | 4                  |
| Op. sec. Hartman per laparoscopiam                   | 3                  |
| Reconstructio colonis post. Hartman                  | 2                  |
| Resectio colonis transversi per laparoscopiam        | 2                  |
| Perforatio recti iatrogenes                          | 1                  |

shortest operations were partial coeectomies that lasted for 78 minutes in average. The laparoscopic surgery causes less inconvenience to our patients; the post-surgical pain being less intense with less analgesic. After a laparoscopic surgery, bowel movements restored faster, the patients were mobilised faster, enteral feeding started earlier and the hospital stay was shorter.

We have nineteen (13.9%) conversions. The most frequent reason for conversions was the bulky tumour, which were growing into the surrounding structures and could not be separated from them in a laparoscopic operation. List of causes for conversions are listed in Table 2.

It is generally known the blood consumption in laparoscopic surgery is lower than in open surgery. There was no need for transfusion in our patients, not intraoperatively neither after the operation.

**TABLE 2**  
LIST OF REASONS FOR CONVERSION

| Reason for conversion   | Number of patients |
|---|--------------------|
| Tumour attached to abdominal wall, subileus (1 <sup>st</sup> lap. Op.)                                      | 1                  |
| Inability to visualise left urether (2 <sup>nd</sup> laparoscopic op.)                                      | 1                  |
| Diverticulum sigmae that perforated in mesentery  | 1                  |
| Tumour infiltrated urinary bladder wall   | 4                  |
| Tumour ingrowths abdominal wall   | 3                  |
| Tumour penetrates in retroperitoneum  | 3                  |
| Too large rectal tumour   | 2                  |
| Too narrow pelvis with low rectal tumour  | 1                  |
| Left urether injury   | 1                  |
| Inability to make adequate adhesiolysis of small intestine loops for reconstruction after Hartman procedure | 1                  |
| Urether injury and small intestine tumour   | 1                  |

During the operation we have had 2 left urether injuries, so conversions and reconstructions have been performed.

Serious complications were encountered during the post-operative course in four cases with only one fatal outcome.

In a one patient, who had been subjected to a sigmoid colon resection, a localized accumulation of urine – urinoma – occurred fifteenth day after the operation, due to a left urether lesion not recognized during the operation. The lesion was cured by minimally invasive approach: the urinoma was drained under CT guidance, which was also used when a temporary nephrostoma was applied. Later on, the urologist placed a »double J« catheter over the lesion, which successfully healed.

Another complication occurred as a minor dehiscence of anastomosis in a patient previously subjected to the low resection of the rectum affected by carcinoma, and was treated conservatively.

In the third patient, after a right hemicolectomy, peritonitis developed as a consequence of a lesion of the small intestine during the adhesiolysis. A laparotomy was performed, along with the re-sewing of the area of the lesion. All three patients had a normal post-surgical recovery.

The only patient who died in postoperative period was 86-year-old male who underwent laparoscopic sigmoid resection for malignant disease. Fifth day after the operation patient had multi organ failure that could not be managed so a patient died on the eighth day from surgery.

With those major complications we had another four minor complications including wound infections and minor wound dehiscence. We did not encountered any port-site metastasis until now.

## Discussion

In spite of the fact that the results of the laparoscopic surgery were published more than ten years ago, this technique has not been widely accepted<sup>4-12</sup>. The reason for this could probably be the lack of adequate equipment and skilled surgical team. The early reports pleaded for the possibility of the disease dissemination following laparoscopic surgery<sup>16,17</sup>. Nevertheless, later researches have clarified that the oncological standards can, be achieved even in the laparoscopic surgery of colon for carcinoma<sup>2,3,16-22</sup>.

A long-term survival is the most important objective for colon carcinoma surgery. The present-day randomised studies have shown that the results obtained in laparoscopic surgery seem to be entirely comparable with the results following open surgery technique. Consequently, for the stage I–III patients, the five year survival period following the open surgery treatment is up to 60%, while after the laparoscopic surgery is up to 73%<sup>7,21</sup>. On the other hand, the frequency of the occurrence of port site metastases is 0–1.3%<sup>6,11,13-16,23</sup>, whereas the frequency of metastases in the surgical wound following

open surgery, ranges 0.7–1%<sup>13,25</sup>. In other words, frequency of recurrence may be defined as similar in both, laparoscopic and open surgery<sup>5</sup>.

The most important quality of the laparoscopic surgery is in its potential superiority over the open surgical technique in the locally advanced colon carcinoma treatment (stage III or Dukes C – patients with lymph nodes metastases). According to some observations, for this group of patients the long-term survival curve, after the laparoscopic operation, has been described as the same, or similar to the results achieved in the patients with the stage II disease (free from metastasising into lymph nodes). The phenomenon has been defined as down-staging following laparoscopic surgery. On the other hand, the prospective of the disease stage III patients, previously subjected to an open surgical intervention, appears significantly inferior as compared to the disease stage II patients. The survival curve in the disease stage II have reached similar values regardless of whether they have been treated in open or laparoscopic surgery<sup>5,25–27</sup>. Indeed, it is well known for the laparoscopic surgery that it causes a lower degree of stress in comparison with the open surgery. Consequently, the damage for the immunological function of the organism has been lower, and it is precisely the immunological response that plays the key role for the progression and metastasising of the tumour. Anyhow, the probability for metastasising in stage I and II patients appears to be lower and not dependent on the immunological status. On the other hand, in the disease stage III patients, it is precisely the immunological status that may be of crucial importance for a long-term survival<sup>28–30</sup>.

It has become customary to look upon the laparoscopic surgery related to the large intestine resection, as the one requiring significantly higher expenditures than those incurred in the relative open surgery. For this reason, we have estimated the cost of consumption material

and hospitalisation for both, an »ideal« laparoscopic and an open low rectum resection<sup>15</sup>. The intra-and/or post-operative complications free surgery was considered as »ideal«. Accordingly, a laparoscopic operation appears more expensive as compared to the one performed in open technique. However, the hospital stay has resulted costlier when the open surgery is concerned (parenteral and enteral feeding with special preparations, for a longer period of time). On the whole, some specific and most frequent laparoscopic operations on the colon, having considered the above described circumstances and the rules applied in the subject estimate, have produced a cost somewhat lower and amounting to €1,380, whereas the open technique and subsequent curing have resulted in the amount of €1,393. As it is evident, in view of all that has been done and said, the prices of the laparoscopic and open technique surgery on the final part of the large intestine appear comparable if in a laparoscopic operation the same reusable instruments (trocars) are used, as it has been the practice in our hospital.

In view of a relatively small number of patients, and taking into consideration the diversity of the cases, it has not been possible to elaborate the statistics or to produce a formal presentation of our results. It is possible to present our observations; however they are similar to those reported by other authors<sup>31,32</sup>. We find for the laparoscopic surgery to be much more agreeable with the patients, they suffer less pain in the post-operative stage and require fewer analgesics. The peristalsis in these patients is restored earlier; they leave bed faster, they can be given per oral feeding sooner and remain in hospital for a shorter period of time.

In view of our results and those achieved by other authors, the results and the cost of the colon laparoscopic surgery can be compared with the results obtained with the open technique, including also the laparoscopic surgery for carcinoma.

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## LAPAROSKOPSKA KIRURGIJA KOLONA – NAŠI REZULTATI

### S A Ž E T A K

Nekada je laparoskopna kirurgija bila prihvaćena kao metoda izbora za benigne bolesti i palijacijske operacijske zahvate u uznapredovalim stadijima malignih bolesti kolona. Međutim, danas je laparoskopna kirurgija kolona također usvojena i u operacijskom liječenju malignih bolesti kolona. Prva laparoskopna resekcija kolona učinjena je u našoj Klinici 12. prosinca 2002., te je do 1. lipnja 2007. laparoskopnom metodom uspješno je operirano 114 pacijenata. Od 114 pacijenata bilo je 56 muškaraca i 57 žena, prosječne dobi 65 godina (raspon 28–86). Niz različitih laparoskopnih operacija učinjen je poglavito u liječenju malignih bolesti kolona (80%). Prijeoperacijski postupak, priprema pacijenata, kao i izbor operacijskog zahvata bili su identični onima koji se primjenjuju u otvorenoj kirurgiji. Pacijenti s karcinomom kolona bili su operirani po principima onkološke radikalnosti. U poslijeoperacijskom periodu imali smo osam komplikacija (četiri manje i četiri veće), od kojih je samo jedna završila fatalnim ishodom. Prema našem iskustvu i podacima iz recentne literature, možemo zaključiti da su rezultati laparoskopne kirurgije usporedivi s rezultatima u otvorenoj kirurgiji.