

**Laparoscopic colorectal surgery for cancer in a regional service hospital: single surgeon experience****Bölgesel bir hizmet hastanesinde kansere yönelik laparoskopik kolorektal cerrahi: tek cerrah deneyimi**

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**ÖZET**

**AMAÇ:**Kanıtlanmış avantajlarına rağmen bölge hizmet hastanelerinde laparoskopik kolorektal cerrahi yeterince kullanılmamaktadır. Türkiye'nin Orta Karadeniz Bölgesi'ndeki bir hizmet hastanesinde bir gastroenteroloji cerrahi tarafından laparoskopik cerrahi ile tedavi edilen kolorektal kanserli hastaların sonuçlarının değerlendirilmesi amaçlanmıştır.

**GEREÇ ve YÖNTEM:** Laparoskopik kolorektal cerrahi uygulanan ardışık her hastanın verileri prospektif olarak kaydedildi ve retrospektif olarak analiz edildi. Kaydedilen parametreler demografik özellikler, teşhis çalışmaları, cerrahi olaylar, ameliyat sonrası morbidite, mortalite ve sonuçları içeriyordu.

**BULGULAR:** Kırk aylık bir süre içinde 75 hastaya kolorektal kanser nedeniyle laparoskopik cerrahi uygulandı. Ortalama yaş 66,4 olup erkeklerin kadınlara oranı 11:4'tür. Rektum kanseri oranı %65,3, kolon kanseri oranı yüzde 34,6 idi. Bir hastada senkron kolorektal kanser tespit edildi. Ortalama ameliyat süresi 276 dakika ve ortalama kanama hacmi 75 ml idi. Açık rezeksiyona geçiş oranı %6,6 idi. Ortalama hastanede kalış günü altı gündü. Ameliyat sonrası komplikasyon oranı (Clavien-Dindo derecesi  $\geq$  III) %8,5 idi. Takip sırasında iki sistemik nüks gözlemlendi.

**SONUÇ:** Sonuçlarımız ve araştırmada sunulan diğer çalışmalar doğrultusunda, yüksek vaka sayısına sahip eğitimli bir cerrah, gelişmekte olan bir ülkenin bölge hizmet hastanesinde güvenli ve yeterli onkolojik laparoskopik kolorektal prosedürü gerçekleştirebilir. Sağlık politikalarının ve bölgesel koşulların ilimizdeki ve ülkemizdeki cerrahi uygulamalar üzerine olan etkisini göstermesi açısından da sonuçlarımız değerlidir. Özellikle kalabalık hizmet hastanelerinde uzun ameliyat süresi uygulamanın dezavantajıdır. Mevcut şartlarda cerrahların özverisi ve ilgili her türlü destek gereklidir.

**Anhtar Kelimeler:** Cerrah, Hastane, Kapasite, Kolorektal kanser, Minimal invazif cerrahi

**ABSTRACT**

**AIM:** In spite of the demonstrated advantages, laparoscopic colorectal surgery is not adequately utilised in regional service hospitals. Purpose of the research was to document the findings of patients managed by a gastroenterological surgeon for colorectal neoplasms using laparoscopic surgery at a service hospital of the Central Black Sea Region, Turkey.

**MATERIAL AND METHOD:** Every sequential patient having laparoscopic colorectal surgery was registered prospectively and analysed retrospectively. Recorded parameters consisted of demographic characteristics, diagnostic work-up, surgical events, post-surgical morbidity, mortality and outcomes.

**RESULTS:** Seventy-five patients each underwent laparoscopic colorectal surgery for colorectal neoplasm within a period of forty months. Average age was 66.4 years and ratio of males to females was 11:4. Rectal cancer rate was 65.3%. Colon cancer rate was 34.6%. One patient had synchronous colorectal cancer. Mean time of surgery was 276 min and mean volume of haemorrhage was 75 ml. Conversion to open resection rate was 6.6%. Median day of hospitalization was six days. Postoperative complication rate (Clavien-Dindo grade  $\geq$  III) was 8.5%. Two systemic recurrences were observed during the surveillance.

**CONCLUSION:** Based on our results and those of other studies presented here, a trained surgeon with a high caseload can perform safe and adequate oncological laparoscopic colorectal resections in a regional service hospital of a developing country. The longer operative time is the drawback of the procedure, especially in crowded service hospitals. The results are also valuable in terms of showing the effect of health policies and regional conditions on surgical practices in our city and country. Under the current conditions, surgeons' dedication and all relevant supports are required.

**Keywords:** Colorectal cancer, Hospital, Minimally invasive surgery, Surgeon, Volume

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## INTRODUCTION

The minimally invasive approach for colorectal diseases has been used since 1991. After initial concerns, which were overcome by the results of several trials, the laparoscopic approach has progressively gained popularity.<sup>1-4</sup> Especially, high-volume and/or academic centers currently prefer this approach. The majority of the supporting informations were acquired from these centers.<sup>5-8</sup> Although researches favour the surgical method, it can not be applied easily due to factors predicting the outcomes with surgery, such as the surgeon,<sup>9-12</sup> case volume of a hospital,<sup>6</sup> the development level of a country.<sup>13,14</sup> Therefore, success of the researches may not be possible in all hospitals. We hypothesized that a standard surgical procedure, which has started with surgical gastroenterology training in high-volume central hospitals and continued in low-medium volume regional hospitals can balance the predictive factors that are stated to be effective on surgical results. So, results of our study were compared with outcomes of high volume tertiary centres and/or multi-centres.

## MATERIAL and METHOD

This research was approved by the ethics committee (Decision number: 2023/9/4). The hospital is a 600-bed, tertiary hospital, in The Middle Black Sea Region. The General Surgery Clinic consists of nineteen experts, 7 of them are in the training staff. Also clinic consists of two inpatient services with twenty-six patient capacity. Based on a recent study,<sup>6</sup> the hospital was classified as an intermediate-volume hospital for colorectal cancer because there were fewer than 135 annual non-urgent minimally invasive surgery. The study involved sequential patients who had laparoscopic surgery for colorectal malignancies performed by a single gastroenterological surgeon over a forty-month period from May 2019 to October 2022. Data were collected prospectively over this period and analyzed retrospectively. Emergency surgeries, open surgeries and laparoscopic surgeries performed by other specialists were excluded from the study.

Preoperative colonoscopy was performed in all patients and the diagnosis of carcinoma was confirmed by biopsy. Perioperative evaluation consisted of physical examination and standard laboratory test. Colonoscopy was done to investigate the characteristics of the tumour. All patients had abdominal and chest computed tomography scans to exclude metastatic disease. Pelvic MRI was utilised in rectal cancer patients to obtain further information on tumour depth and lymph node status.

All patients had preoperative mechanical bowel cleansing on the day before surgery. Intravenous broad-spectrum antibiotics were administered at induction of anaesthesia. Low molecular weight heparin and antithrombotic stockings were used in all patients in the perioperative period and continued for 10 days after the patient was discharged. Any patient suffering from colorectal cancer was assumed to be appropriate for laparoscopic surgery if there were no specific contraindications.

### Surgical Technique:

We maintained pneumoperitoneum with 12-14 mmHg carbon dioxide. The basic rules of medial to lateral dissection and proximal ligation of the lympho-vascular pedicle were exactly obeyed for all patients.

**Surgery for the left colon and rectum:** Inferior mesenteric vein (IMV) is identified at the lower border of pancreas and dissected from surrounding structures. IMV is then held up and the peritoneum incised. The Toldt fascia is dissected free from the prerenal fascia. The IMV is clipped and divided. The transverse mesocolon is held up and the mesocolon is lifted off the anterior surface of the pancreas. After the entrance to the lesser sac dissection proceeds along the upper border of the pancreas. The greater omentum is then divided above the transverse colon and the splenic flexure is taken down. The rectosigmoid is held up and the peritoneum on the right leaf of the rectal mesentery is incised just posterior to the inferior mesenteric artery (IMA) at the level of the sacral promontory. A larger plane is established and left ureter and gonadal vessels are visualised as well as retroperitoneal structures. Nodal dissection is then completed at the root of the IMA and IMA is clipped and divided. Holding up the IMA, and IMV, separation of the Toldt from the fascia of Gerota is completed. The posterior mesorectal plane is determined at the level of the promontorium and dissected. The total mesorectal excision (TME) is performed. Rectal wall is dissected circumferentially and the dividing

of the distal border is carried out with linear staplers. Pfannenstiel incision is made and the distal end is pulled out after placement of a wound protector. An intracorporeal side-to-end anastomosis is fashioned using a circular stapler (usually 31 mm). In case of a Miles procedure is performed, the splenic flexure is not fully mobilized and the specimen is extracted through the perineum. A protective ileostomy is created in patients with previous chemo-radiotherapy or TME and low colorectal-coloanal anastomosis.

**Surgery for the right colon:** The root of the right colon mesentery is held up to identify the ileocolic vessels. Following the vascular division, the mesocolon is dissected from the retroperitoneum. Dissection plane is kept away from the head of pancreas, left ureter and gonadal vessels. The right branches of the middle colic vein are ligated and the hepatic flexure is freed from the lateral peritoneal attachments. The proximal bowel margin is labelled in the distal ileum and then the distal bowel margin is determined in the transverse colon. A midline incision is made to exteriorise the colon. The mesentery is divided. Distal and proximal bowel margins are transected with endoscopic linear stapler. A side to side ileocolic anastomosis is made by using a circular stapler (usually 28 mm).

**Surgery for isolated transverse colon:** IMV is identified at the lower border of pancreas and dissected from peritoneal attachments. IMV is then held up and the peritoneum incised. The Toldt fascia is dissected free from the prerenal fascia. The IMV is clipped and divided. The transverse mesocolon is held up and the mesocolon is lifted off the anterior surface of the pancreas. After the entrance to the lesser sac dissection proceeds along the lower border of the pancreas. The middle colic trunk is identified and the vascular pedicle divided just distal to the inferior aspect of the pancreas. The greater omentum is then divided above the transverse colon. Hepatic flexure is freed from the lateral peritoneal attachments. A midline incision is made to exteriorise the colon. The mesentery is divided. Distal and proximal bowel margins are transected with endoscopic linear stapler. A side to side colo-colic anastomosis is made by using a circular stapler (usually 28 mm).

**Postoperative care:** On the third postoperative day, oral fluids were allowed and started on a diet after the patients had flatulence or bowel movements. On the fourth postoperative day, parenteral analgesics were discontinued and urinary catheters were withdrawn. Patients who tolerated the diet were frequently discharged on the fifth or sixth postoperative day.

**Postoperative complications:** Morbidity and mortality occurring during hospitalization or within 90 days after surgery were defined as postoperative complications. They were classified using the Clavien-Dindo (CD) system.<sup>15</sup>

Subsequent to pathological examination, patients were staged according to the 8th edition of the American Joint Committee on Cancer staging system.<sup>16</sup>

Recorded parameters consisted of demographic characteristics, diagnostic work-up, surgical events, post-surgical morbidity, mortality and outcomes. The data were entered into a Microsoft Excel worksheet and analyzed retrospectively.

## RESULTS

Over the study period, there were sixty eight emergency surgery, one hundred ninety six elective open surgery and, twelve laparoscopic elective surgery performed by other specialists and these were excluded. The study included seventy-five sequential patients who had laparoscopic surgery by a gastroenterological surgeon for colorectal malignancy. Case-load for laparoscopic colorectal surgery was 23 operations per year. The median age of the patients was 65 years (range 31-91 years) with a male:female ratio of 11:4. In the preoperative work-up, 46 (61,3%) patients were ASA grade 3, 27 (36%) were ASA grade 2, and 2 (2,7%) were ASA grade 4. Thirty seven patients had low anterior resection, fourteen had right hemicolectomy, eleven had anterior resection and ten had left hemicolectomy, two had isolated transverse colon resection, one had abdominoperineal resection. One patient had minimally invasive laparoscopic total abdominal colectomy for synchronous colorectal cancer. Conversion to open surgery was required in five patients (6.6%). Difficulty in identifying the lesion due to extensive adhesions after hysterectomy, appendectomy and subtotal gastrectomy was the reason in three of them. Others were bleeding and locally advanced disease.

Mean time of surgery and mean operative blood loss were 275±51 min and, 75.6±44.6 ml, respectively. Median day of hospitalization was six (range 4-21 days). Six patients underwent simultaneous laparoscopic procedures; three cholecystectomies, one gastric wedge

resection, one unilateral salpingoophorectomy and one liver metastasectomy. Clavien-Dindo complications  $\geq$ Grade III complications were observed in 6 (8.5%) patients; Grade III in 4 (5.7%) patients, Grade V in 2 (2.8%). Preperitoneal hematoma at the pfannenstiell incision occurred in two (2.8%) patients who used anticoagulants for coronary artery disease, ileus in one (1.4%), anastomotic leak in one (1.4%), anastomotic stenosis in one (1.4%). There were one Hartmann's procedure for anastomotic leak, one balloon dilatation for anastomotic stenosis, and one percutaneous drainage and antibiotic treatments for preperitoneal hematoma at the pfannenstiell incision site. The ninety-day postoperative mortality rate was %2.8. One patient died after a suicide attempt in the 2nd month, while another one died in the intensive care unit due to multiple organ failure within 24 hours after the emergency surgery for bridg ileus in the 1st month. The final histologic diagnosis of the resected specimens revealed: The mean number of harvested lymph nodes was  $17.3 \pm 10$  and there was only one positive circumferential resection margin. Forty-six of cases were categorized as stage 0, I or II colorectal cancers on final histopathological review as per TNM classification, 28 were stage III, and the remaining 1 patient had a single incidental liver metastasis at the time of surgery (stage IV). She refused adjuvant chemotherapy. According to a mean follow-up of  $18.6 \pm 10.8$  months, she was diagnosed with multi-metastatic liver cancer 5 months after the surgery, but still alive for 24 months, and one patient who was underwent low anterior resection developed metachronous cecum tumor and peritoneal carcinomatosis. Cytoreductive surgery and hyperthermic intraperitoneal chemotherapy were applied. Also, there were any local recurrences for the follow up period.

## DISCUSSION

A number of important conclusions emerge from this study. These should be interpreted in the context of a study of 75 sequential unselected patients with colorectal cancer operated on by a single gastroenterological surgeon in a regional service hospital. In order to qualify as a high-volume surgeon, a precise minimum number of cases per year per surgeon is not defined.<sup>17-19</sup> However, according to a recent study,<sup>20</sup> assessing the value of the surgeon's caseload in predicting result after elective minimally invasive colorectal surgery, high-caseload is defined as surgeon who perform  $>20$  procedures per year. Our surgery clinic is classified as a mid-volume, with 85 elective colorectal cancer surgeries annually.<sup>6</sup> The operating surgeon's case-load for laparoscopic colorectal surgery as a member of this clinic was 22 elective operations annually. However, it is not sufficiently utilised among other members of surgical clinic. The longer operative time is the drawback of the procedure, especially in a regional service hospital of developing country due to case burden is a current problem.<sup>21</sup> If the learning curve is optimised, operative time can be decreased. Unfortunately overcoming this curve is not so easy in a crowded service hospital.<sup>22</sup> Because, as a consequence of high patient-load, broad spectrum of surgical procedures may prevent adequate specialization. A training which has started with surgical gastroenterology fellowship in a high-volume central hospital can balance the time required for achieving learning curve and allow focus on specific interests, like minimally invasive colorectal surgery. Other possible reasons that make laparoscopic procedures less attractive: As a consequence of working in a large surgical team, number of monthly elective surgical days per surgeon is limited; in a developing country, health policies make remuneration based on performance; older surgeons are reluctant to learn new techniques. In our opinion, surgeons' sacrifice, health policies' and hospital managers' support are required to overcome these reasons.

As compared the other studies

Outcomes	Şenol et al. <sup>17</sup> n=75	Hücher et al. <sup>18</sup> n=1332	Veldkamp et al. <sup>19</sup> n=527/534*	Nelson et al. <sup>20</sup> n=435	D'Ambiha le et al. <sup>21</sup> n=302	Hewett et al. <sup>22</sup> n=254	Yanamoro et al. <sup>23</sup> n=529	Blomdi et al. <sup>24</sup> n=207
Age (year) Mean $\pm$ SD / Median (range)	65 (31-91)	67.5 $\pm$ 10.9	71 (27-92)	70 (28-96)	66.1 $\pm$ 11.3	71.1 $\pm$ 10.4	64 (28-75)	65.7 $\pm$ 12.89
BMI (kg/m <sup>2</sup> ) Mean $\pm$ SD / Median (range)	26 (16-40)	25.4 $\pm$ 3.1	24.5 (12.1-37.1)	ND	ND	25.8 $\pm$ 4.5	22.9 (14.8-36.1)	24.16 $\pm$ 3.06
ASA score 1-2 3-4	36% 64%	69% 31%	82% 18%	86% 14%	ND	71.8% 28.2%	ND ND	65.2% 34.8%
Tumor stage 0-1-2 3-4	61.3% 38.7%	57% 43%	65% 34%	71% 28%	63% 37%	70.9% 28.6%	53.1% 46.9%	48.4% 51.6%
Operative time (minute) Mean $\pm$ SD / Median (range)	275 $\pm$ 59	211.4 $\pm$ 83	202 (50-540)	150 (35-450)	226 $\pm$ 71	158(49-365)	211 (80-616)	165.3 $\pm$ 37
Blood loss (ml) Mean $\pm$ SD / Median (range)	75.6 $\pm$ 44.6	ND	100 (0-2700)	ND	59 $\pm$ 100	100 (0-1400)	30 (0-4080)	108.71 $\pm$ 85.91
Postoperative length of stay (day) Mean $\pm$ SD / Median (range)	6 (4-21)	10 $\pm$ 7.1	8.2 $\pm$ 6.6	5 (4-6)	11 $\pm$ 5	9.5 $\pm$ 7.4	10 (8-13)	8.72 $\pm$ 3.2
Anastomotic leak	1.4%	8.3%	3%	ND	5%	1.4%	3.6%	0
Conversion to open	6.6%	10.3%	17%	21%	10%	14.6%	5.4%	15.9%
30-day mortality	1.4%	1.2%	1%	<1%	ND	1.4%	0	0
90-day mortality	2.8%	ND	ND	14%	1.3%	ND	ND	0
Amount of lymph nodes resected	17.3 $\pm$ 10	15.4 $\pm$ 9.2	10 (3-20)	12 (ND)	14 $\pm$ 8	13 (1-74)	21 (2-85)	12.36 $\pm$ 4.36
Follow-up (month) Mean $\pm$ SD / Median (range)	18.6 $\pm$ 10.8	54.2 $\pm$ 14.7	52 $\pm$ 17	52.8 (ND)	210(-75)	60*	60*	53*
Cancer Recurrence	2.6%	13.3%	19.6%	17.4%	ND	13.7%	ND	29%
Definitive stoma	0	2.8%	ND	ND	ND	ND	ND	ND

ND not defined, \* standard deviation or range is not defined

23-30 we determined a slightly longer operating time. It was thought that approximately 80% of the patients in our study consisted of left colon and rectal cancer, also approximately 70% of the rectal cancers located in the middle and lower rectum. So that mobilisation of the splenic flexure, which is a more technically demanding procedure, might have caused this difference.

In this study, the rate of conversion to open surgery was 6.6%, which was comparable to reported in other studies.<sup>23-30</sup> included accredited surgeons, which ranged between 5.4% to 21%. Six patients (8.5%) had Clavien-Dindo complications  $\geq$ Grade III complications. The 30-day mortality rate and anastomotic leak rate (one case of anterior resection) were 1.4%. This rate was comparable with the studies.<sup>23-30</sup> and ranged between 0% to 1.4% for the 30-day mortality and 0% to 8.3% for the anastomotic leak. In our study the mean blood loss and the median postoperative hospital stay were  $75.6 \pm 44.6$  ml and 6 (4-21) days, respectively. Although some studies reported<sup>23, 24, 27, 28</sup> more blood loss, the others<sup>26, 29</sup> were better (Table 1). The postoperative hospital stay was comparable with the studies<sup>23-30</sup> (Table 1).

The oncological results of laparoscopic colorectal surgery is very significant. It's represented by negative surgical margins and sufficient number of retrieved lymph nodes. The mean value of harvested lymph nodes for the study group was comparable to others<sup>26, 28, 30</sup> ( $17.3 \pm 10$  vs.  $15.4 \pm 9.2$ ,  $14 \pm 8$  and,  $12.3 \pm 4.3$ ). Also, reported median values ranged between ten to twenty-one.<sup>23-25, 27, 29</sup> Only one patient who underwent laparoscopic total abdominal colectomy for synchronous colorectal cancer had positive circumferential surgical margins. No local recurrence was observed in a mean follow-up of  $18.6 \pm 10.8$  months, however two systemic recurrences were detected: one multi-metastatic liver cancer; one metachronous cecum tumor and peritoneal carcinomatosis. Table 1 summarises that the results produced at high volume centres and/or multi-centres might be repeated in a regional service hospital by a single surgeon with a sufficient surgical volume.<sup>23-30</sup> As the limitations of the study, we are aware that these results should be cautiously analysed because of the limited participants and follow-up period.

## CONCLUSION

Based on our results and those of other studies presented here, a trained surgeon with a high caseload can perform safe and adequate oncological laparoscopic colorectal resections in a regional service hospital of a developing country. The longer operative time is the drawback of the procedure, especially in crowded service hospitals. The results are also valuable in terms of showing the effect of health policies and regional conditions on surgical practices in our city and country. Under the current conditions, surgeons' dedication and all relevant supports are required.

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SS: Data analysis and interpretation, drafting the article, final approval of the version to be published. MK: Substantial contributions to



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