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Simultaneous Colon and Liver Laparoscopic Resection for Colorectal Cancer with Synchronous Liver Metastases: A Single Center Experience

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Abstract

Background: The one-stage approach for colorectal cancer (CRC) with synchronous liver metastases (SLM) has demonstrated advantages, when feasible, in terms of oncological radicality and reduction in sanitary costs. The simultaneous laparoscopic approach to both colon cancer and liver metastases joins the advantages of mini-invasiveness to the one-stage approach.

Methods: During the period from February 2011 to July 2017, a single surgeon performed 17 laparoscopic colorectal operations with simultaneous liver resection for CRC with SLM. Colorectal procedures included 9 rectal resections, 6 left colectomies, and 2 right colectomies. Associated hepatic resections included 1 left hepatectomy, 1 right posterior sectionectomy, 2 segmentectomies, and 13 wedge resections. We analyzed retrospectively the patient's short-term outcome and operative and oncologic results.

Results: There was no conversion to open surgery. Six patients (35%) had minor complications (Clavien–Dindo grade I–II), whereas only 2 patients (12%) had major complications (Clavien–Dindo grade III–IV) and no mortality occurred. The median time of discharge was 8.6 (range 5–36) days. We obtained 94% of R0 resection margin on the liver specimen and 100% of negative distal and circumferential margin in case of rectal resection. An average of 20 lymphnodes were retrieved in the colorectal specimen.

Conclusions: Simultaneous mini-invasive colorectal and liver resection is a challenging but feasible procedure. The advantages of treating primary cancer and metastases in the same recovery justify the morbidity rate, especially because the most of the complications are minor and no cases of mortality occurred. Further experience is needed to better understand how to reduce the morbidity rate.

Keywords: simultaneous resection, colorectal resection, synchronous liver metastases, laparoscopic surgery, colorectal cancer

Introduction

Colorectal cancer (CRC) is the third most common cancer worldwide and the fourth cause of death for malignancy.[1] At diagnosis, about 15%–25% of patients have synchronous liver metastases (SLM) and only a minority of patients has a resectable liver disease.[2–4] The one-stage approach for CRC with resectable SLM has demonstrated advantages, when feasible, in terms of oncological radicality and reduction in costs, without increasing cumulative morbidity and mortality.[5–11] The decision to perform a simultaneous or staged resection depends on multiple variables, such as complexity of hepatic and colorectal resection, patient's performance status and underlying comorbidities, besides symptoms, location, and extent of disease.[9] Surgery is still the only curative treatment for liver metastases, but nowadays an important role is played by adjuvant chemotherapy, which has improved the response and survival rates for these patients. In this scenario, a faster recovery of the patient after surgery is paramount, to favor a prompt start of chemotherapy.[2–4,11–13] Laparoscopy has become a standard practice for the treatment of both colon and rectal cancer, due to the well-known advantages in terms of shorter hospital stay and faster recovery of the patient if compared to the open approach, with similar oncological outcome.[3,14–17] On the contrary, the mini-invasive approach for the treatment of liver metastases

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has gained acceptance only in the last few years. The difficulties encountered in the development of this kind of surgery are mainly related to a steep learning curve, especially in case of major hepatectomies and posterior segments.[18,19] Moreover, major concerns regard aspects such as risk of bleeding, fear of gas embolism, and oncological safety.[3,18,20] Laparoscopic liver resections (LLR) are challenging procedures, but the association with several advantages, including decreased morbidity rate (such as wound and pulmonary complications), less need for blood transfusion, earlier recovery of the patient, and facilitation of iterative hepatic surgery, has been demonstrated.[4,18,20,21] Furthermore, LLR have similar oncological outcome if compared with open surgery.[3,20,22–25] Nevertheless, the laparoscopic synchronous approach to both CRC and liver metastases is still uncommon, as demonstrated by the limited number of patients included in most of the series published in literature.[4,26–43]

This retrospective study has the goal to analyze the short-term and oncological outcome of simultaneous laparoscopic resection of CRC and liver metastases on a series of 17 patients.

Materials and Methods

From February 2011 to July 2017, a single surgeon L.V. performed 17 simultaneous resections of CRC with SLM. Eleven patients were males, 6 patients were females Eliminate (M/F 1,8) and the median age was 65 (range 46–88) years. Patients were preoperatively staged according to the TNM classification following colonoscopy, three-phases computed tomography of chest-abdomen-pelvis, and pelvic and/or abdominal magnetic resonance if further imaging was requested. The metastatic disease was a single liver nodule for 10 patients (59%), whereas in 7 cases (41%), multiple metastases were detected, with an average diameter of 28.8 (range 10–69) mm. Localization and characteristics of primary tumor and liver metastases at preoperative assessment are summarized in Table 1.

Table 1. Patients' Demographics and Preoperative Assessment

Variable	*Patient, n = 17*
Patients	
Age [mean ± SD, range (years)]	65.2 ± 12.5 (46–88)
Gender, M/F	11/6
BMI [mean ± SD, range (kg/m^2)]	24.6 ± 5.1 (41–19)
Symptoms, Y/N	17/0
ASA score (I/II/III)	5/7/5
ECOG (0/1)	9/8
CHT, Y/N	0/17
RT, Y/N	0/19
Colorectal tumor	
Location	
Right colon	2
Left colon	6
Rectosigmoid junction	5
Upper rectum	1
Middle rectum	3
Lower rectum	0
cTNM	
T 1/2/3/4	0/2/1/14
N 0/1/2	3/4/10
Liver metastases	
N. hepatic nodules[a]	
Single	10
Multiple	7
Location	
Unilobar	12
Bilobar	5
Anterolateral	23
S 2/3/4b/5/6	5/5/6/5/2
Posterior	5
S 4a/7/8	1/1/3
Size (cm)	
≤2	17
>2	11

[a]N. nodules 28.

ASA, American Society of Anesthesiologist physical status score; BMI, body mass index; CHT, chemotherapy; cTMN, clinical TNM stage; ECOG, Eastern Cooperative Oncology Group performance status; RT, radiotherapy; S, segment; SD, standard deviation.

In agreement with the multidisciplinary team, none of the patients underwent chemotherapy or radiotherapy previous to surgery, because they suffered from severe stenosis and/or bleeding. All patients had a preserved hepatic function (Child-Pugh A), and there was no evidence of other metastases at preoperative CT scan, except in 2 cases of pulmonary nodules. Five patients (29%) had been previously operated. Preoperative assessment included evaluation of the surgical risk (ASA score) and the Eastern Cooperative Oncology Group performance status (ECOG). ASA IV patients were excluded, whereas the age itself was not considered as a contraindication if an ECOG 0-1 performance status was assigned.[44]

Colorectal procedures included 2 right colectomies, 6 left colectomies, and 9 rectal resections, 5 with partial mesorectal excision (PME), 3 with total mesorectal excision (TME) and 1 Miles operation.

Hepatic resections included 1 left hepatectomy, 1 right posterior sectionectomy, 2 segmentectomies and 14 wedge resections (Table 2). We retrospectively analyzed the patient short-term outcome as primary endpoint, while operative and oncologic results were evaluated as secondary endpoints. Thirty-day mortality and morbidity rate were evaluated, according to the Clavien–Dindo classification.[45] Moreover, we analyzed postoperative transfusion rate and time of discharge. Operative results included median operative time, estimated blood loss (EBL), need for intraoperative transfusion and conversion rate. Finally, we analyzed oncological results in terms of number of harvested lymph nodes, rate of negative distal and circumferential resection margin for the primary cancer, and rate of R0 resection for the secondary tumor. Liver resections were defined as R0 if the neoplasm was microscopically more than 1 mm from resection margin.[46]

Operative technique

Trocars were positioned for the standard colorectal resection (3 accesses, 4 trocars in 1 case of rectal resection), but in 11 cases (65%) an additional trocar was introduced to allow the hepatic resection. Colorectal procedures were conducted using an ultrasound, radiofrequency or combined energy device, depending on the availability of surgical instruments during the years (Table 2). The usual technique provided a lateral-to-medial approach for left colon and

Table 2. Surgical Technique and Operative Results

Variable	*Data*
No. of trocars	
3	6
4	10
5	1
Colorectal resection	
Right colectomy	2
Left colectomy	6
Proctectomy	8
Miles	1
Anastomosis	
Intracorporeal	15
Extracorporeal	1
No	1
Hepatic resection	
Wedge resection	13
Segmentectomy	2
Right sectionectomy	1
Left hepatectomy	1
Pringle maneuver	
Yes	0
No	17
Hemostatics	
Yes	5
No	12
Device	
Electrocoagulation	4
Ultrasound	3
Radiofrequency	2
Combined energy	8
Conversion to open	
Yes	0
No	17
Intraoperative transfusion	
Yes	2
No	15
Operative time (t)	
$t \leq 120'$	4
$120' < t \leq 180'$	7
$180' < t \leq 240'$	4
$t > 240'$	2

rectum and a medial-to-lateral resection for right colectomy. Specimens were extracted through a 5 cm incision protected by an impermeable bag. The elective laparotomy was a Pfannenstiel incision, whereas only in one case a median minilaparotomy was performed, to allow an extracorporeal anastomosis after right colectomy. In all other cases, the bag was used to temporarily close the abdominal wound, pneumoperitoneum was inducted and an intracorporeal anastomosis was performed.

During hepatic resection, liver ligaments were not sectioned if not strictly necessary, with the utmost respect for anatomy allowed by the laparoscopic caudal approach to the liver. The Pringle maneuver was not routinely used, but a preparation of the hepatic pedicle for clamping was considered to be useful in case of difficult and extensive resections. Intraoperative ultrasound was always performed previous to hepatic resection for excluding additional metastases and to mark the resection line. The transection was conducted using the device, but we opted for diathermy in 4 cases of small peripheral wedge resection. Minor vessels were divided between clips, major biliovascular structures were closed using Hem-o-lock clips or endoscopic staplers as needed, after accurate identification and isolation from the surrounding parenchyma. The vascular outflow was controlled intraparenchymally using endoscopic staplers, when the transection was almost completed. Hemostasis and biliostasis were accurately achieved using the device and single propylene stitches only when required. In 5 cases (29%) hemostasis was refined using hemostatics (Table 2). The liver specimen was extracted through the incision previously performed and protected by the bag.

Results

All patients underwent a pure laparoscopic approach and the hepatic resection had a curative intent for most of them (13 cases). Two patients underwent a wedge resection in the left segments as first step of a ‘‘two stage’’ hepatectomy. Other 2 patients had a diagnosis of nonresectable bilobar liver metastases, but a wedge resection was requested by the oncologist to obtain a histological examination of the liver nodules for receptor analysis.

There was no 30-day mortality and a global morbidity of 47% (8 patients). Six patients (35%) had minor complications (Clavien–Dindo grade I–II), whereas only 2 patients (12%) had major complications (Clavien–Dindo grade III–IV) (Table 3). One of the patients who underwent subtotal proctectomy with TME and metastasectomy was reoperated for anastomotic leakage and needed recovery in intensive care unit because of sepsis. The other patient was discharged in postoperative day (POD) 8 after subtotal proctectomy with PME and left epatectomy, but he was readmitted 2 weeks later for biliary fistula and treated with endoscopic stent.

The median time of discharge was 8.6 (range 5–36) days. There was no conversion to open surgery. The median operative time was 165 (range 75–320) minutes. The average EBL was 158 (range 10–400) mL, but an intraoperative transfusion was necessary in 2 cases (12%) (Table 4). The rate of postoperative blood transfusion was 12% (2 patients).

We achieved R0 resection margin on the liver specimen in all cases except 1 (94%), a 100% negative circumferential and distal resection margin for the rectum, and a medium number of 20 lymph nodes was retrieved in the colorectal specimen.

Table 3. Postoperative Complications

Clavien–Dindo grade	*Complications*	*Pt*	N
I	Pleural effusion	1	2
	Bleeding	1	
II	Pneumonia	2	4
	Ascites	1	
	Atrial fibrillation	1	
III	Biliary fistula	1	1
IV	Sepsis due to intestinal leakage	1	1

Pt, patients.

Table 4. Patients' Characteristics, Operating Procedures, Surgical, and Oncologic Outcome

N	*Age*	*Sex*	*BMI*	*Comorbidity*	*Previous surgery*	*cTMN*	*Colorectal surgery*	*Hepatic surgery*	*EBL (mL)*	*Intraop RBC*	*Postop RBC*	*Morbidity*	*Hospital stay (days)*	*RO*
1	46	M	23	No	N	T4N1	TME	WR	400	N	N	Nil	7	Y[a]
2	77	M	21.5	No	N	T4N2	LC	WR	200	N	N	Nil	7	Y
3	55	F	23.5	No	N	T4N2	LC	WR	20	N	N	Nil	7	Y[a]
4	65	F	26	HHD COPD	N	T4N1	LC	WR	20	N	N	Nil	7	Y
5	88	M	25.6	Atrial flutter (PM) COPD	Y	T4N1	Miles	S	400	N	Y	Pneumonia	10	Y
6	61	F	20	Hypothyroidism	N	T3N0	TME	WR	200	N	N	Nil	6	Y
7	47	F	21	CLD HCV+	N	T4bN1	LC	WR	50	N	N	Pleural effusion	5	Y
8	75	M	23	Diabetes Hypertension PulmM	N	T4N2	LC	WR	200	N	N	Ascites	6	N/A[b]
9	68	M	24	PM	N	T4N2	AR (PME)	WR	150	N	N	Nil	8	Y
10	47	M	23	Hypertension	N	T4N2	RC	WR	20	N	N	Rectal bleeding	6	N/A[b]
11	64	F	19	No	Y	T2N0	AR (PME)	WR	10	N	N	Atrial fibrillation	5	Y
12	62	M	41	Diabetes Hypertension	Y	T4N2	LC	WR	150	N	N	Nil	5	Y
13	69	M	23	COPD Hypertension Previous PulmS	Y	T4N2	RC	WR	50	N	N	Nil	5	Y
14	76	M	23	Atrial fibrillation CLD HCV+	Y	T4N2	AR (PME)	LHep	200	Y	N	Biliary fistula	8	Y
15	65	M	27	No	N	T4N2	AR (PME)	S	200	N	N	Nil	5	N
16	85	M	23	HHD	Y	T4N2	AR (PME)	RLS	400	Y	N	Pneumonia	11	Y
17	59	F	32	Diabetes HHD	Y	T2N0	TME	WR	20	N	Y	Anastomotic leak, sepsis	36	Y

[a]First time of ''two stage'' hepatectomy, macroscopically R2, but microscopically R0.
[b]Hepatic resection for receptor analysis.
AR (PME), anterior resection with partial mesorectal excision; CLD, chronic liver disease; COPD, chronic obstructive pulmonary disease; cTMN, clinical TMN stage; EBL, estimated blood loss; F, female; HHD, hypertensive heart disease; LC, left colectomy; LHep, left hepatectomy; M, male; N, no; N/A, nonapplicable; PM, pacemaker; PulmM, pulmonary metastases; PulmS, pulmonary surgery; RBC, red blood cell; RC, right colectomy; RLS, right lateral sectionectomy; S, segmentectomy; TME, total mesorectal excision; WR, wedge resection; Y, yes.

Discussion

The management of patients with CRC and resectable SLM is not codified at all. There are several options of treatment for this subset of patients, including ''one-stage'' surgery, ''liver first,'' and ''colon first'' approach. The one-stage approach for CRC with SLM has the advantage of solving both colon and liver disease in a single operation, thus avoiding two surgical procedures in a short period of time, which would entail psychological stress for the patient and increased sanitary costs.[4,5,8,10,11,47] The management of patients affected by synchronous colorectal liver metastases depends on a multifactorial evaluation, based on complexity of hepatic and colorectal resection, patient's performance status and underlying comorbidities, besides symptoms, location, and extent of disease.[21] The one-stage approach may not be appropriate if extensive hepatectomy is needed and colorectal resection is expected to be difficult to perform.[2,5] Shubert et al. have demonstrated the reduction of cumulative major morbidity and mortality rates in case of simultaneous approach when a minor hepatic resection is needed, regardless of the complexity of the colorectal resection.[11] Furthermore, a simultaneous major epatectomy can be safe and effective if there are good conditions, such as favorable resection of primary cancer and good performance status of the patient.[4,31] On the contrary, a contraindication to the synchronous resection could be the presence of severe cardiopulmonary comorbidities, especially in elderly patients.[2,48] When the primary cancer is symptomatic and a colorectal resection is recommended to solve or prevent obstruction and/or bleeding, a simultaneous resection could be preferred if a colonic stent is not indicated. In these cases, a one-stage radical operation prevents a delay in the surgical treatment of the secondary tumor, related with an increased risk of metastatic spread.[21]

The aim of laparoscopy is to reduce postoperative pain and wound morbidity, especially when a large incision would be required in open surgery, thus allowing earlier mobilization, a faster recovery of the patient and a prompt start of adjuvant chemotherapy.[13,18,20,21] Laparoscopy for the treatment of CRC has demonstrated better results if compared with the open approach in terms of need for transfusions, shorter recovery, and time of discharge, with similar rate of complications and oncological results.[14–17] Furthermore, in the last years, laparoscopy has gained acceptance also in the treatment of liver metastases, demonstrating better short-term results, without compromising the oncologic outcome.[3,19,20,22] The main obstacle to the development of this challenging surgery is a steep learning curve, in addition to patient's selection.[18] The need for a ''change of view'' from the open ventral approach to the laparoscopic caudal approach, together with the lack of tactile sensation due to laparoscopy, is the main difficulty encountered by the hepatic surgeon in the era of mini-invasiveness.[49] The Morioka Difficulty Scoring System was elaborated with the intention to assist surgeons in selecting patients eligible for LLR according to the individual learning curve, by providing an objective appreciation of the complexity of a given LLR.[49,50] According to the Southampton Guidelines, laparoscopic left lateral sectionectomy (LLS) and minor resections in anterolateral segments are considered a standard practice.[22] Nonetheless, an adequate experience in both colon and liver laparoscopic surgery is required for simultaneous resections, and this factor is often a limit, because not all centers have surgeons properly skilled in both procedures.[31,51]

The patients of this series were studied preoperatively and selected for laparoscopic synchronous resection according to their performance status and operative risk (ASA score). ASA IV patients were excluded, whereas the age itself was not a contraindication if an ECOG 0-1 performance status was assigned. These criteria had the purpose to select patients who were fit both for laparoscopic surgery and simultaneous resection. They presented with symptoms such as abdominal pain due to stenosis, subocclusion and/or bleeding. The patients with stenosis were not eligible for endoscopic stenting. Hence, we opted for an ''upfront'' surgery because resection is mandatory before starting systemic chemotherapy among patients with severe intestinal symptoms.[52] None of the patients had a preoperative diagnosis of low rectal cancer, but one patient operated for bleeding and stenosis caused by rectosigmoid junction cancer had an intraoperative diagnosis of synchronous ultralow rectal cancer after exploration in narcosis. Neither the preoperative proctoscopy nor the CT scan had revealed the low rectal cancer, but an intraoperative histological examination confirmed the diagnosis and the patient underwent a Miles operation, because of clinical evidence of sphincters' invasion.

Hepatic or colorectal resection was performed first, according to the more difficult and extensive procedure. Especially when a major hepatectomy eventually requiring the pedicle clamping was performed, the liver was resected before colorectal resection, to avoid the risk of bowel (and anastomotic) congestion. In fact, the surgeon did not use the Pringle maneuver routinely, avoiding the splanchnic blood flow congestion and the consequential edema of the intestinal bowel, which can favor anastomotic leakage.[4]

The most complications observed in the study (35%) were minor (Clavien–Dindo I–II), such as pulmonary infection, cardiac arrhythmia, ascites and rectal bleeding (Table 4). Two patients (12%) experimented major complications (Clavien–Dindo III–IV), one of them having a life threatening complication, but no mortality occurred. A 59-year-old female underwent proctectomy with TME, ''ghost ileostomy'' and synchronous wedge resection in segment V–VIII. She had a good performance status (ECOG 1), but she also had comorbidities, such as diabetes and hypertensive heart disease (ASA III). In the postoperative course, the patient received multiple transfusions for anemization without evidence of blood loss from the drainages. She was finally reoperated for anastomotic leakage and stayed in intensive care unit because of sepsis. The patient was discharged in POD 36 after complete recovery on the ward. A 76-year-old male who underwent subtotal proctectomy with PME and left hepatectomy was discharged in POD 8, but he was readmitted 2 weeks later with diagnosis of abdominal collection due to a biliary fistula. He was drained by percutaneous approach and then successfully treated with an endoscopic stent.

The overall morbidity rate (47%) observed in the series could be explained by the complexity of this kind of surgery. In fact, the asynchronous risk of morbidity reported in the literature for isolated laparoscopic colorectal and hepatic resection is 19%–45% and 10%–15%, respectively.[13,18,53] Ferretti et al.[54] published the largest series of simultaneous laparoscopic resections in the setting of a multicenter international study. In a retrospective noncomparative analysis, a morbidity rate of 31% was observed. The morbidity rate presented in our series is higher than the most of results found

Table 5. Authors' Results[26–43,51,54]

Author	Year	Study	N[a]	Right-sided CR	Left-sided CR	Subtotal CR	Rectal resection	Miles	Minor Hep	Major Hep	Operative time (minutes)[b]	EBL (mL)[b]	Morbidity	Mortality	Hospital stay (days)[c]
Bizzoca et al.	2019	CS	17/17	2	6	/	8	1	16	1	165	158	8/17	No	8.6 (5–36)
Chen et al.[51]	2019	CM	61/122	15	4	2	37	3	61	/	206	200	14/61	No	6.0 (5–9)
Shim et al.[26]	2018	CM	22/123	3	1	/	18	/	20	2	135	100	2/22	No	8.5 (5–22)
Chen et al.[27]	2018	CS	16/38	4	/	/	12	/	13	3	320	369	4/16	No	11.6 ± 5.2
Gorgun et al.[28]	2017	CM	14/43	N/A	N/A	/	8	/	12	2	321	347	1/14	No	6.4 ± 0.8
Xu et al.[29]	2018	CM	20/20	8	7	/	5	/	16	4	246	175	3/20	No	9.0 (8–12)
Ivanecz et al.[30]	2017	CM	10/10	3	3	/	4	/	10	/	261	105	5/10	No	8.0 (8–12)
Ratti et al.[31]	2016	CM	25/25	5	8	/	12	/	19	6	420	350	6/25	No	9.0 (4–17)
Ferretti et al.[54]	2015	MIS	127/142	38	46	/	55	3	125	17	360	200	44/142	3/142	8.0 (3–84)
Berti et al.[32]	2015	CS	35/35	10	8	/	16	1	35	/	240	200	5/35	2/35	8.0 (4–30)
Jung et al.[33]	2014	CM	24/24	2	1	/	21	/	18	6	290	325	4/24	No	8.0 (5–23)
Inoue et al.[34]	2014	CS	8/10	2	3	/	3	/	8	/	452	245	2/8	No	13.5 (10–18)
Ida et al.[35]	2014	CS	10/10	2	3	/	4	1	10	/	550	400	2/10	No	13.5 (10–45)
Takasu et al.[36]	2014	CM	7/14	2	1	/	4	/	7	/	472	152	1/7	No	16.2 ± 6.1
Spampinato et al.[37]	2013	CS	4/5	/	3	/	1	/	/	4	495	475	1/4	No	6.0 (5–8)
Hoekstra et al.[38]	2012	CS	2/5	1	1	/	/	/	2	/	227	250	1/2	No	17.5 (30–5)
Hu et al.[39]	2012	CM	13/26	3	4	/	1	5	11	2	313	258	1/13	No	8.5 ± 1.9
Polignano et al.[40]	2012	CS	13/28	7	2	/	4	/	13	/	370	50	3/13	No	7.0 (3–54)
Lee et al.[41]	2010	CS	10/10	4	/	/	6	/	9	1	401	500	1/10	No	10.5 (7–15)
Patriti et al.[42]	2009	CS	1/7	/	1	/	/	/	1	/	240	1500	No	No	9.0
Sasaki et al.[43]	2009	CS	9/82	2	/	/	5	2	9	/	418	219	N/A	No	9.0 (3–37)

[a]No. of pure laparoscopic approach/No. of cases in the series.
[b]Median values.
[c]Values are presented as mean ± standard deviation, or median (range).
CM, case matched; CS, case series; CR, colonic resection; EBL, estimated blood loss; Hep, hepatectomy; MIS, multicenter international study; N/A, not available.

in literature (Table 5), probably because all cases considered technically feasible in laparoscopy were included in the study. Even though only 12% of major complications occurred, this brought us to evaluate if a better selection of the patients could increase the postoperative results. The limited number of patients of the series and the retrospective nature of the study did not allow us a further analysis.

Despite the complications, no mortality occurred and the median hospital stay was 8.6 days, similar to other authors' results[26,29–33,39,42,43,54] (Table 5). In fact, minor complications (grade I–II) usually do not considerably affect either the postoperative course or the time of discharge. The simultaneous resections were carried out safely, with no need for conversion to open surgery. The median operative time was 165 (range 75–320) minutes, in contrast with the evidence of long operative time needed in case of laparoscopic performances.[28,31,38,54] An average EBL of 158 (range 10–400) mL was observed, and this result is comparable to other experiences found in literature, or even more favorable[26,28,31,36,54] (Table 5). These results are probably a consequence of the surgical skills as well as the prevalence of wedge resections in the series. Nonetheless, in 2 cases an intraoperative blood transfusion was needed, but both patients had low preoperative hemoglobin and cardiovascular comorbidities. These data confirm the evidence that laparoscopy allows optimal hemostasis, thanks to a better-magnified view and the effect of pneumoperitoneum.[49]

In the last few years, oncologic outcome has been a major concern about LLR, as well as the completeness of TME in case of rectal resection. In both cases, there is evidence in the literature that laparoscopy can offer the same results as the open approach.[22,50,55] In our series, a R0 resection on the liver specimen was achieved in 94% of cases, as well as a 100% negative distal and circumferential resection margin in case of rectal surgery. Moreover, a medium number of 20 lymphnodes were retrieved in the colorectal specimen, according to the guidelines for CRC resection.[56,57]

This retrospective analysis of simultaneous laparoscopic liver and colorectal resection is supported by several international experiences, even if all the published studies are retrospective and the most of the series are small. Lupinacci et al.[47] analyzed 14 articles, which included 39 laparoscopic simultaneous resections, and concluded that LLS associated with CRC resection is safe and feasible and should be routinely proposed.

More recently, Moris et al.[58] reviewed the literature and selected 12 studies, 8 of them retrospectively comparing laparoscopic versus open simultaneous resection. The short-term and oncologic results were analyzed, and similar outcomes for open and mini-invasive resections were observed, with a trend favoring the laparoscopic approach in terms of length of stay and EBL.

In conclusion, this retrospective study on a series of 17 patients operated by a single surgeon suggests that simultaneous mini-invasive colorectal and liver resection is a challenging but feasible procedure. In our experience, the advantages of mini-invasiveness and of treating primary cancer and metastases in the same recovery justify the high morbidity rate, considering that most of the complications are minor and no cases of mortality occurred. Further studies with a larger number of patients are required to better understand if a more accurate selection of patients could further improve the surgical outcome and reduce the morbidity rate.

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Authors' Contributions

I confirm that all authors qualify for authorship according to the Uniform requirements for the articles published by ICMJE.

Disclosure Statement

No competing financial interests exist.

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