Outcomes of Emergent Laparoscopic Sigmoid Resection for Hinchey III Diverticulitis: Does specialization matter?

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ABSTRACT

Background: *Sigmoid resection for perforated diverticulitis is one of the most common emergency surgeries and often performed by general surgeons. Relationship between high-volume surgeons and improved postoperative outcomes is well established. However, the influence of colorectal specialization on outcomes after emergency laparoscopic sigmoidectomy for perforated diverticulitis is not well described.*

Aim: *Evaluate the impact of colorectal surgery training on the outcomes after emergency laparoscopic sigmoid resection for Hinchey III diverticulitis.*

Design: *Retrospective analysis of prospectively collected database.*

Method: *Patients undergoing emergent laparoscopic sigmoid resection for perforated (Hinchey III) diverticulitis were identified and stratified by involvement of colorectal or general surgeon. This study was conducted from 2000 to 2018 at a teaching hospital. Primary outcome measures were primary anastomosis, postoperative morbidity and mortality.*

Results: *A total of 101 patients were identified; 58 by colorectal and 43 by general surgeons. Patients in the colorectal surgeon group had higher rates of primary anastomosis (CS: 98, 2% vs. GS: 67, 4%, p<0.001). General surgeons performed more ostomies (CS: 13, 8% vs. GS: 46, 5%, p<0.001), had a higher conversion rate (CS: 20, 6% vs. GS: 39, 5%, p=0.03) and longer mean length of hospital stay (CS: 6, 2 vs. GS: 10, 8 days, p<0.001). Overall morbidity (CS: 34, 4% vs. GS: 46, 5%, p=0.22), anastomotic leak rate (CC: 3,5% vs. CG: 6,8%, p=0.48) and mortality (CS: 1, 7% vs. GS: 9,3 %, p=0.08) were similar between groups.*

Conclusion: *Emergency laparoscopic sigmoid resection by general surgeons wasn't associated with higher rates of postoperative morbidity, anastomotic leakage or mortality. However, patients operated by colorectal surgeons had higher rates of primary anastomosis, lower rates of ostomy, conversion and shorter length of hospital stay.*

Keywords: *Perforated Diverticulitis; Hinchey III; Colorectal Surgery; Laparoscopic Surgery.*

INTRODUCTION

Perforated diverticulitis is one of the most common pathologies requiring emergent surgery and is often managed by GS. Despite evidence that laparoscopic approach and primary anastomosis (PA) are safe in the emergent setting[1-7], the surgery of choice for many surgeons is still open Hartmann's procedure (HP). Usually, the decision regarding what operation to perform is influenced by many factors: patient's comorbidities, hemodynamic stability, intraoperative findings such as grade of peritonitis, and surgeon's skills and expertise[8-9].

The relationship between high volume surgeons and patient's outcomes and how the results of an operation are influenced by specialty have been described among different procedures[10-13]. In colorectal surgery, some studies have shown that patients operated by high volume surgeons are benefited from significant reduction in morbidity, mortality, length of hospital stay (LOS) and rate of stoma formation[14-17]. In addition, surgeon´s specialization in colorectal surgery had shown similar benefits in the elective and emergency scenario[18-21]. Consequently, it is reasonable to believe that management of perforated diverticulitis by CS may result in better outcomes. However, robust information about the influence of specialization in colorectal surgery on outcomes after minimally invasive surgery for perforated diverticulitis is still lacking. Therefore, the aim of this study was to evaluate the impact of colorectal surgery training on the outcomes after emergent laparoscopic sigmoid resection for perforated diverticulitis.

MATERIALS AND METHODS

Aim

Evaluate the impact of colorectal surgery training on the outcomes after emergency laparoscopic sigmoid resection for Hinchey III diverticulitis.

Variables analizadas

Los datos analizados incluyeron: edad, sexo, índice de masa corporal (IMC), clasificación de la American Society of Anesthesiologists (ASA), número de episodios previos de diverticulitis y antecedentes quirúrgicos. Las va-

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TABLE 1: DEMOGRAPHICS AND PREOPERATIVE VARIABLES

	CS group	GS group	P
	n 58	n 43	
Sex Female, n (%) Male, n (%)	 15 (25,9%) 43 (74,1%)	 19 (44,2%) 24 (55,8%)	 0.053
Mean age, (range) years	58,9 (32-81)	64,8 (30-87)	0.02
Mean BMI, (range) kg/m^2	25,3 (18-33)	25,8 (19-40)	0.6
ASA, n (%) I II III IV	 13 (22,4%) 37 (63,8%) 8 (13,8%) 0 (0%)	 6 (13,9%) 22 (51,2%) 12 (27,9%) 3 (7%)	 0.28 0.20 0.07 0.07
Previous abdominal surgery, n (%)	8 (13,8%)	10 (23,2%)	0.21
Previous episodes of diverticulitis, n (range)	1,3 (0-6)	0,5 (0-4)	0.92

** CS= Colorectal surgeon; GS= General surgeon. BMI= body mass index; ASA= American Society of Anesthesiologists.*

riables perioperatorias como la clasificación de Hinchey, la proporción de RAP, conversión, tiempo operatorio, complicaciones intraoperatorias, proporción de estomas y la presencia de CC o CG al momento del procedimiento también fueron registradas. También se analizaron la estadía hospitalaria, la morbilidad (según la clasificación de Clavien-Dindo) y mortalidad postoperatoria a 30 días.

Study design and population

Data were collected prospectively from all patients who underwent laparoscopic colectomy for diverticular disease during the period 2000-2018. Patients with laparoscopic sigmoid resection for acute complicated diverticulitis (Hinchey III assessed intraoperatively) were included for the analysis. The sample was divided in two groups: patients operated by a CS or by residents assisted by a CS and those operated by a GS or by residents assisted by a GS. A surgeon was defined as a GS if he or she had a completed general surgery training and was board certified, whereas CS if he or she had a complete general surgery residency and a colorectal surgery residency/fellowship and board certified. All the surgeons participating in this study were fully trained at our institution where laparoscopic surgery and colorectal procedures are commonly performed in a daily basis. All doctors in the general surgery residency program were considered residents.

The indication of emergent colectomy was based on the presence of clinical peritonitis and computed tomography (CT) findings of diffuse free intraperitoneal air or fluid. Generally, patients undergo surgery within a few hours of the diagnosis. Laparoscopy was the preferred approach when the patient was hemodynamically stable. After gaining access to the abdominal cavity, the Hinchey grade was assessed. Hinchey Grade III and IV were defined as an intraoperative finding of purulent or fecal peritonitis, respectively. Surgical approach was based on the surgeons´ criteria. All patients received pre-operative intravenous antibiotics but no mechanical bowel preparation because of emergent presentation.

This study was approved by the institutional review board (IRB) of our institution. The written informed consent was waived by the IRB owing to the study's retrospective nature.

Variables and Outcomes

Data collected included age, gender, body mass index (BMI), American Society of Anesthesiologists (ASA) classification, history of diverticulitis, previous abdominal surgeries, and CT findings. Perioperative variables such as Hinchey classification, rate of resection and primary anastomosis, conversion rate, operative time, intraoperative complications, protective ostomy rate, and the presence of CS or GS at the time of the procedure were also registered. Recovery parameters such as length of hospital stay (LOS), morbidity scored as Clavien-Dindo classification, and mortality rate were also considered for analysis.

Statistical analyses

The student's t-test was used to compare continuous variables, whereas the χ^2 and Fisher test were used for categorical variables. A p value <0.05 was considered statisti-

TABLE 2: OPERATIVE VARIABLES

	CS group	GS group	P
	n 58	n 43	
Mean operative time, (range) minutes	184 (80-390)	197 (80-345)	0.29
Conversion rate, n (%)	12 (20,6)	17 (39,5)	0.03
Intraoperative complications, n (%)	2 (3,4) 1 bladder injury 1 iatrogenic colonic perforation	1 (2,3) 1 mesenteric vein lesion	0.74
Primary anastomosis, n (%)	57 (98,3)	29 (67,4)	<0,001
Without ileostomy	50 (86,2)	23 (53,5)	<0,001
With ileostomy	7 (12,1)	6 (13,9)	0,78
Hartmann's procedure, n (%)	1 (1,7)	14 (32,6)	<0.001
Ostomy, n (%)	8 (13,8)	20 (46,5)	<0.001
Surgical trainee as primary surgeon, n (%)	24 (41,4)	35 (81,4)	<0.001

** CS= Colorectal surgeon; GS= General surgeon.*

cally significant for all tests.

RESULTS

During the study period, 1,770 patients underwent laparoscopic colorectal surgery. Laparoscopic colectomy for diverticular disease was performed in 415 patients (23.4%). The indication for surgery was: recurrent diverticulitis in 279 patients; acute complicated diverticulitis in 106 patients; and other complications such as stenosis, fistula or bleeding in 30 patients. One hundred and one patients were classified as Hinchey III intraoperatively. Of those 58 were operated on by a CS and 43 by a GS.

Although demographics data were generally homogeneous between groups, patients operated by CS were younger (CS: 58.9 vs. GS: 64.8 years, p=0.02) (Table 1).

Patients in the CS group had higher PA (CS: 98.3% vs. GS: 67.4%, p<0.001) and PA without ileostomy rates (CS:86.2% vs. GS: 53.5%, p<0.001). On the contrary, GS performed more HP (CS: 1.7% vs. GS: 32.6%, p<0.001), ostomies (CS: 13.8% vs. GS: 46.5%, p<0.001) and had a higher conversion rate (CS: 20.6% vs. GS: 39.5%, p=0.03). Mean operative time and rate of intraoperative complications were similar between groups. Surgical trainees performed as primary surgeon more frequently in GS group (CS: 41.4% vs. GS: 81.4%, p<0.001) (Table 2).

Mean LOS was longer in GS group (CS: 6.2 vs. GS: 10.8 days, p<0.001). Overall postoperative morbidity (CS: 34.4% vs. GS: 46.5%, p=0.22), anastomotic leak rate (CS: 3.5% vs. G2: 6.8%, p=0.48) and mortality rate (CS: 1.7% vs. GS: 9.3 %, p=0.08) were similar between groups. All anastomotic leaks occurred in patients with PA without proximal diversion. Three patients (5.1%) of the CS group were readmitted (2 acute renal failures and 1 patient with fever) and only 1 (2.3%) of the GS group because of rectal stump leak (p=0.46). Four patients of the GS group died (3 for septic shock and 1 for acute respiratory distress) and only one in the CS group (acute respiratory distress) (p=0.08) (Table 3).

DISCUSSION

Several studies tried to address the impact of colorectal specialization on patient's postoperative outcomes. Most of them are in the elective setting for malignant or diverticular disease. For instance, Barbas et al[22] showed that surgeon specialization was an independent factor of improved overall survival after colon cancer resection. Similarly, lower rates of recurrence and higher disease specific survival was demonstrated among colorectal cancer patients operated on by specialists[23-24]. Rea et al[17] used the US Nationwide Inpatient Sample to determine if surgeon's specialization improved clinical outcomes after colorectal resections. They analyzed 115,540 procedures performed by 13,925 surgeons and concluded that specialized surgeons had lower risk of mortality and decreased LOS when compared to nonspecialized surgeons. Furthermore, Callahan et al[25] used the New York database and reported that overall mortality after colectomy was substantially lower when performed by specialists (specialist 2.4% vs. nonspecialist 4.8%). Di Carlo et al[26] conducted a cohort study of patients undergoing surgery for diverticular fistulas. They found that patients operated by a CS had improved outcomes, with lower rates of diverting procedures (CS: 5.4% vs. GS: 27%, p=0.013), shorter

TABLE 3: POSTOPERATIVE COMPLICATIONS (CLAVIEN-DINDO CLASSIFICATION)

Clavien-Dindo	CS group	GS group	P
	n 58	n 43	
I, n (%)	11 (19) 5 fever 3 ileus 3 wound infection	10 (23,3) 3 fever 3 wound infection 1 wound hematoma 2 others 1 ileus	0,59
II, n (%)	4 (6,9) 2 respiratory tract infection (ATB) 1 parenteral nutrition 1 urinary tract infection (ATB)	0 (0)	0,07
IIIa, n (%)	1 (1,7) 1 colonoscopy for anastomotic bleeding	0 (0)	0,38
IIIb, n (%)	3 (5,1) 2 anastomotic leak 1 evisceration	5 (11,6) 2 anastomotic leak 2 evisceration 1 rectal stump leak	0,23
IV, n (%)	0 (0)	1 (2,3) 1 evisceration	0,42
V, n (%)	1 (1,7) 1 acute respiratory distress	4 (9,3) 3 septic shock 1 acute respiratory distress	0,08
Total, n (%)	20 (34,4)	20 (46,5)	0,22

** CS= Colorectal surgeon; GS= General surgeon.*

LOS (CS: 11 vs. GS: 14 days, p=0.001) and lower rate of complications (CS:27% vs. GS: 41.2%).

A high proportion of emergent colorectal resections are performed by general surgeons. Some studies tried to address if specialist management of this patients may result in better postoperative outcomes expressed by: less morbidity, mortality and higher proportion of mini-invasive, and one stage-procedures. Zorcolo et al[20] analyzed 336 patients with colorectal emergencies that included cancer and diverticulitis and found that specialization increased PA rates (CS: 64.3% vs. GS: 36.5%, p<0.001) and reduced postoperative morbidity (CS: 14.5% vs. GS: 24.3%), without differences in LOS. Biondo et al[27] performed a similar study in which specialists achieved higher percentage of PA but with lower postoperative morbidity, mortality, and anastomotic dehiscence. None of the surgeries where laparoscopic and obstructions were more frequent in the CS group whereas perforation was the most common presentation among patients in the GS group. Kulaylat et al[21] performed a retrospective cohort study of patients undergoing emergent colorectal resections, and after propensity score matching they found that CS surgeries were associated with lower postoperative morbidity and 30-day mortality. The minority of procedures were laparoscopic (CS: 31.6% vs. GS: 9.8%) and they did not have data regarding anastomotic leak. Moreover, Gibbons and colleagues[28] found higher rates of PA (CS: 85.5% vs. GS: 28.7%, p<0.001) and lower stoma rates (CS: 40.4% vs GS: 88.8%, p<0.001) with similar morbidity and mortality. CS group operated more patients for cancer and GS group for acute diverticulitis. In line with these findings, we also found significantly higher rates of PA in CS group. Interestingly, our rates of PA among GS was also relatively high (almost 70%). This may be explained by the early and exhaustive adoption of minimally invasive surgery by our trainees during the residency program.

Specialist influence on colorectal resections for diverticulitis has also been studied. Boyce et al[19] conducted a retrospective study of management of acute diverticulitis analyzing changes in their outcomes previous and after the establishment of a colorectal surgery unit. They found that specialist management of this patients was associated with a reduction in stoma formation (46.6% to 27.7%), in-

crease in PA rate (50.3% to 77.9%) and reduction in mortality (3.3% to 1.5%). It is worth to mention, however, that the authors did not report the severity of diverticulitis and rate of laparoscopic approach. Goldstone et al[18] recently analyzed data from New York State database of all patients who underwent PA with diversion and HP for acute diverticulitis. Of 10,780 patients, 98.3% received a HP and only 1.7% PA with diversion. GS performed most of the procedures (94%). PA rate was higher (4.2% vs. 1.5%) and mortality lower (7.5% vs. 5.3%) among CS. Laparoscopic approach was used only in 4% of the patients and they were unable to compare some important variables between groups like Hinchey classification. In our institution, almost 70% of patients who presented with perforated diverticulitis were initially approached by laparoscopy with a high success rate[29]. In contrast with the studies mentioned above, morbidity, mortality and anastomotic leak rates were similar between patients operated on by CS or GS. Despite one-staged procedures were more frequent among the CS group, similar postoperative outcomes were achieved by GS. Our results highlight the importance of early laparoscopic and colorectal training through residency because GS on call will still manage many patients with perforated diverticulitis. In our series, CS participated in almost 60% of all procedures. This finding is probably related to the fact that some CS are on call during week days.

Limitations of this study include its retrospective nature, which is the main limiting factor. There was also bias in the selection of surgical procedure, which was at the surgeon discretion at the time of the procedure. In addition, our results represent the experience of a teaching hospital in which GS were thoroughly trained in laparoscopic colorectal surgery and this may not be generalizable to other centers. Despite these limitations, to our knowledge this is the first study that analyzed the relationship between specialization and postoperative outcomes after laparoscopic sigmoid resection for perforated Hinchey III diverticulitis. Most of studies about influence of colorectal specialization on outcomes after emergent colorectal resections include heterogeneous populations and mostly operated by a conventional approach.

CONCLUSIONS

Emergent laparoscopic sigmoid resection performed by GS was not associated with higher rates of postoperative morbidity, anastomotic leakage or mortality. However, patients operated by CS had higher rates of PA, lower rates of ostomy and conversion, and reduced LOS as compared to those operated by GS.

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