SCIENTIFIC PAPER JSLS

Complications of Laparoscopic Gynecologic Surgery

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ABSTRACT

Background and Objectives: To analyze the frequency of complications during laparoscopic gynecologic surgery and identify associated risk factors.

Methods: A descriptive observational study was performed between January 2000 and December 2012 and included all gynecologic laparoscopies performed at our center. Variables were recorded for patient characteristics, indication for surgery, length of hospital stay (in days), major and minor complications, and conversions to laparotomy. To identify risk factors and variables associated with complications, crude and adjusted odds ratios were calculated with unconditional logistic regression.

Results: Of all 2888 laparoscopies included, most were procedures of moderate difficulty (adnexal surgery) (54.2%). The overall frequency of major complications was 1.93%, and that of minor complications was 4.29%. The level of technical difficulty and existence of prior abdominal surgery were associated with a higher risk of major complications and conversions to laparotomy.

Conclusion: Laparoscopic gynecologic surgery is associated with a low frequency of complications but is a procedure that is not without risk. Greater technical difficulty and prior surgery were factors associated with a higher frequency of complications.

Key Words: Gynecological laparoscopy, Complications, Risk factors, Outcomes.

INTRODUCTION

Laparoscopic surgery has become widely accepted by surgeons and patients as an effective technique to treat gynecologic pathologies.[1] Better recovery, a shorter hospital stay, less postoperative pain, and lower blood loss are the main arguments in favor of this approach.[2–4]

As the technology has improved and surgical skills have increased, the nature and characteristics of laparoscopic procedures have also become more complex. At centers equipped for advanced laparoscopic surgery, procedures such as surgery for complex adnexal lesions, hysterectomies, pelvic floor repair, and resection for severe endometriosis are now performed by this approach.[5]

Although the incidence of complications decreases as surgeons gain experience with laparoscopy,[6,7] the growing difficulty of some procedures in gynecologic surgery may increase the frequency of severe complications (visceral and great vessel injuries).[8] According to published studies, the overall rate of complications ranges from 0.4% to 3%.[5,9–11] Complications can be classified as major or minor: the former involve the viscera (intestine, bladder, or ureter) or great vessels (including severe hemorrhage),[12] whereas minor complications generally have a relatively low impact on the patient's postoperative course.

Only 1 study has appeared on the complications of laparoscopic surgery in a large series of patients in Spain.[13] Accordingly, the aim of this study was to analyze the complications from gynecologic laparoscopies during a 12-year period and identify possible risk factors associated with this type of surgery.

MATERIALS AND METHODS

This descriptive study was designed to include all laparoscopic gynecologic surgeries performed at Hospital Virgen de las Nieves (Granada, Spain) from January 2000 to December 2012. The hospital is a university public hospital serving a population of 500 000 persons. A total of 2888 cases were included. The complex procedures were

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This research was supported by the Department of Obstetrics and Gynecology, Hospital Universitario Virgen de las Nieves, Granada, Spain. We thank K. Shashok for translating the original manuscript into English.

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DOI: 10.4293/JSLS.2014.00058

performed by 4 more experienced surgeons, and the rest of the surgical procedures was performed by 16 surgeons.

Information about patient characteristics, surgical procedure, laparoscopy-related complications, and length of hospital stay was entered into a database for later analysis. This is a descriptive, retrospective study. Ethics committee approval was not needed.

At our center, pneumoperitoneum is generally established with a Veress needle located subumbilically or at the Palmer point, to an intra-abdominal pressure of approximately 15 to 20 mm Hg. In some cases the Hasson technique is used. After adequate pressure is achieved, the infraumbilical trocar is inserted, and after video images are obtained, the remaining trocars (between 1 and 3, depending on the technical complexity of the procedure) are inserted under direct visualization.

The following variables for patients' characteristics were recorded: age, morbid obesity (body mass index >35 kg/m^2), prior abdominal surgery, year of surgery, and length of hospital stay (in days). Age was classified into 3 categories: <30 years, 30 to 64 years, and >64 years. The year of surgery was grouped into three 3-year periods (2000–2002, 2003–2005, and 2006–2008) and one 4-year period (2009–2012).

To facilitate data analysis, the surgical indications for laparoscopy were classified into 3 groups according to the level of technical difficulty. These 3 groups were chosen based on the classifications of Chapron et al,[9] Leonard et al,[10] and Härkki-Sirén and Kurki,[12] although in this study, groups 1 and 2 together were considered technically simple procedures, group 3 was considered moderate difficulty, and group 4 was considered complex surgery. The simple surgery group included tubal electrocoagulation, coagulation of bleeding areas without other procedures, and diagnostic laparoscopy with or without biopsy. The moderate difficulty group comprised ovarian surgery, including endometriosis (management of ectopic pregnancy, adnexectomy, cystectomy, salpingectomy, tubal plasty, and ovarian drilling), and removal of an intrauterine device that had migrated to the abdominal cavity. The complex surgery group included total and subtotal hysterectomy with or without pelvic lymphadenectomy and myomectomy. **Table 1** specifies the procedures in each group.

Complications from laparotomy were classified as major and minor. The former group of intraoperative complications included injury to the hollow organs of the viscera (intestine, bladder, or ureter) and bleeding or infection

Table 1.
Characteristics of Gynecologic Laparoscopies (2000–2012)

	Data
Age [mean (range)] (y)	35.81 (11–85)
Age group [n (%)]	
<30 y	783 (27.1)
30–64 y	2010 (69.6)
>64 y	52 (1.8)
Morbid obesity [n (%)]	51 (1.8)
Prior surgery [n (%)]	455 (15.8)
Period of study [n (%)]	
2000–2002	616 (21.3)
2003–2005	853 (29.5)
2006–2008	750 (26)
2009–2012	669 (23.2)
Level of technical difficulty [n (%)]	
Simple	1074 (37.20)
Tubal ligation	887 (30.70)
Diagnostic laparoscopy	157 (5.40)
Laparoscopy and biopsy	16 (0.60)
Coagulation	14 (0.50)
Moderate	1564 (54.20)
Unilateral adnexectomy	298 (10.30)
Bilateral adnexectomy	151 (5.20)
Salpingectomy	294 (10.20)
Cystectomy	754 (26.10)
Tubal plasty	6 (0.20)
Adhesiolysis	41 (1.40)
Ovarian drilling	5 (0.20)
IUD[a] removal	15 (0.50)
Complex	249 (8.60)
Subtotal hysterectomy	38 (1.30)
Total hysterectomy	104 (3.60)
LAVH[a]	69 (2.40)
Myomectomy	38 (1.30)
Hospital stay [mean (range)] (d)	1.42 (0–33)
Length of hospital stay [n (%)]	
0–2 d	2443 (84.60)
3–7 d	390 (13.50)
>7 d	37 (1.30)

[a]IUD = intrauterine device; LAVH = laparoscopy-assisted vaginal hysterectomy.

during laparoscopy or the postoperative period requiring additional intervention by laparoscopy or laparotomy. Deaths and severe medical pathologies that occurred during the postoperative period were also considered major complications.

Minor complications were recorded when any of the following occurred: anemia, mild bleeding or infection, fever, abdominal wall hematoma, urinary tract infection, postoperative urinary retention, and ileal paralysis. Major and minor complications or >1 minor complication could coexist in a single patient; women with 1 major and 1 minor complication were considered to have a major complication.

The reasons for conversion to laparotomy were classified into 2 groups (conversion because of complications and conversion for technical reasons). Conversion to laparot-

Table 2.
Complications During Gynecologic Laparoscopies, Classified by Level of Difficulty, Conversions to Laparotomy, and Failed Laparoscopies

	Data
Complications during laparoscopy (n = 2888)	
Major complications [n (%)]	56 (1.93) (95% CI, 1.41–2.48)
Intestinal perforation	10 (0.35)
Bladder perforation	4 (0.14)
Serious bleeding complications	37 (1.28)
Serious complications from infection	3 (0.10)
Acute pulmonary edema	1 (0.03)
Death	1 (0.03)
Minor complications [n (%)]	124 (4.29) (95% CI, 3.54–5.05) in 84 patients
Mild anemia	30 (1.04)
Severe anemia (transfusion)	29 (1.01)
Minor bleeding complications	15 (0.52)
Minor complications from infection	4 (0.14)
Wall abscess	1 (0.03)
Vaginal vault abscess	2 (0.07)
Pelvic abscess	1 (0.03)
Nerve lesion	1 (0.03)
Fever	9 (0.31)
Pain of undetermined cause	4 (0.14)
Subcutaneous emphysema	1 (0.03)
External genitalia edema	2 (0.07)
Paralytic ileum	3 (0.10)
Hernia at laparoscopy trocar	1 (0.03)
Urinary tract infection	10 (0.35)
Urinary retention	2 (0.07)
Hematoma (postoperative)	12 (0.42)
Postoperative wall hematoma	11 (0.38)
Postoperative vaginal vault hematoma	1 (0.03)
Uterine perforation	1 (0.03)
Failed laparoscopy (2003–2012) (n = 2272) [n (%)]	81 (3.57) (95% CI, 2.78–4.35)
Conversion to laparotomy because of complications (2003–2012) (n = 2272) [n (%)]	36 (1.58) (95% CI, 1.05–2.12)

omy occurred when any complication arose during laparoscopy that required laparotomy. Failed laparoscopy was recorded when the laparoscopic procedure could not be completed successfully because of inadequate pneumoperitoneum or the presence of any pathology that prevented the surgeon from performing the technique by laparotomy. These 2 variables (conversion to laparotomy and failed laparoscopy) were recorded in the database beginning in the year 2003 (ie, the second 3-year period) and were thus analyzed only for the period from 2003 to 2012.

A descriptive analysis was produced for each variable. Differences between groups were identified with the χ^2 test for qualitative variables. In all analyses based on bilateral comparisons, $P < .05$ was considered statistically significant.

To identify the factors associated with major and minor complications, conversion to laparotomy, or failed laparoscopy, a specific logistic regression model was constructed for each dependent variable, and the crude and adjusted odds ratios were calculated together with their 95% confidence interval (CI). The final regression model was obtained from step-wise analyses with significance of $P < .1$ in the bivariate analysis as the criterion for entering a given factor into the model. All analyses of the data were performed with SPSS software, version 15.0 (SPSS, Armonk, New York).

RESULTS

Between January 2000 and December 2012, a total of 2888 laparoscopic surgeries were performed at our center.

Table 3.
Factors Associated With Complications in Gynecologic Laparoscopies

	Serious Complications (n = 56)	Mild Complications (n = 84)	Conversion (n = 36)	Failed Laparoscopy (n = 81)
Age				
<30 y	6 (0.8%)	29 (3.5%)	4 (0.7%)	22 (3.7%)
30–64 y	46 (2.3%)	51 (2.5%)	29 (1.8%)	54 (3.4%)
>64 y	1 (1.9%)	3 (5.8%)	1 (2%)	4 (7.8%)
P value	.02	.12	.14	.24
Period of study				
2000–2002	11 (1.8%)	17 (2.8%)		
2003–2005	13 (1.5%)	25 (2.9%)	10 (1.2%)	27 (3.2%)
2006–2008	15 (2%)	12 (1.6%)	11 (1.5%)	22 (2.9%)
2009–2012	17 (2.5%)	30 (4.5%)	15 (2.2%)	32 (4.8%)
P value	.544	.015	.24	.12
Prior abdominal surgery				
Yes	19 (4.2%)	8 (1.8%)	12 (3%)	24 (6.0%)
No	37 (1.5%)	76 (3.1%)	24 (1.3%)	57 (3.0%)
P value	< .001	.11	.013	.004
Obesity				
Yes	2 (3.9%)	0 (0%)	2 (4.3%)	10 (21.3%)
No	54 (1.9%)	84 (3%)	34 (1.5%)	71 (3.2%)
P value	.26	.4	.13	< .001
Level of difficulty				
Simple	10 (0.9%)	16 (1.5%)	2 (0.3%)	10 (01.4%)
Moderate	31 (2%)	45 (2.9%)	21 (1.6%)	44 (3.3%)
Complex	15 (6%)	23 (9.2%)	13 (5.8%)	27 (12.1%)
P value	< .001	< .001	< .001	< .001

Table 1 summarizes the characteristics of the patients and the indications for the laparoscopic approach. The mean age was 35.8 years (range, 11–85 years), and 70% of the patients were aged between 30 and 64 years. Prior abdominal surgery was recorded in 15.8% of the patients in this group. Most of the laparoscopies performed at our center during the study period were of moderate technical difficulty (54.2%).

The mean length of hospital stay was <2 days, and 84.6% of the patients were discharged during the first 2 days after the procedure.

As shown in **Table 2**, the percentage rate of major complications was 1.93% (95% CI, 1.43%–2.48%), with bleeding as the most frequent complication, with only 1 due to a major vessel injury. We found a total of 124 minor complications (4.29%), which were recorded in 84 patients.

Among the 2272 laparoscopies, the procedure could not be completed in 117 (5.15%) despite the initial indication for this route of access. Laparoscopy failed (ie, the procedure could not be started) in 3.57% of the cases (95% CI, 2.78%–4.35%), and conversion to laparotomy because of a complication was necessary in 1.58% of the cases (95% CI, 1.05%–2.12%) during the course of the procedure.

In the bivariate analysis, the factors associated with major and minor complications, conversion, and failed laparoscopy are shown in **Table 3**. Patients with prior abdominal surgery had significantly more ($P < .001$) serious complications (4.2% vs 1.5%) and more failed attempts at laparoscopy. A greater level of difficulty of the procedure was associated with both complications and failed laparoscopy ($P < .001$). Obesity and age were also significantly associated with failed laparoscopy ($P < .001$) and serious complications ($P = .02$), respectively.

When we performed the multiple logistic regression analyses (**Tables 4 and 5**), we found that serious complications were significantly more frequent in patients with prior abdominal surgery (adjusted odds ratio, 2.77; 95% CI, 1.44–4.99), and the adjusted odds ratio tended to increase with increasing level of technical difficulty of the procedure. Level of difficulty was also directly associated with conversion to laparotomy and failed laparoscopy.

Table 6 summarizes the serious complications that occurred during laparoscopy. We found 10 cases of intestinal perforation, 3 of which were diagnosed intraoperatively and 7 postoperatively. In all 10 cases conversion to

Table 4.
Variables Associated With Serious and Mild Complications in Gynecologic Laparoscopies: Logistic Regression Analysis

	Serious Complications		Mild Complications	
Variables	cOR[a] (95% CI)	aOR[a] (95% CI)	cOR (95% CI)	aOR (95% CI)
Age group				
<30 y	1	1	1	1
30–64 y	2.4 (0.99–5.79)	2.43 (1.01–5.87)	0.68 (0.43–1.08)	0.56 (0.34–0.93)
>64 y	1.27 (0.14–1.13)	1.48 (0.68–3.11)	1.59 (0.47–5.41)	0.95 (0.26–3.45)
Period of study				
2000–2002	1	1	1	1
2003–2005	0.85 (0.38–1.91)	0.75 (0.32–1.77)	1.06 (0.57–1.99)	1.07 (0.57–2.02)
2006–2008	1.12 (0.51–2.46)	0.80 (0.35–1.85)	0.57 (0.27–1.21)	0.49 (0.23–1.06)
2009–2012	1.43 (0.67–3.09)	0.72 (0.31–1.69)	1.65 (0.90–3.03)	1.10 (0.57–2.11)
Prior abdominal surgery (yes vs no)	2.67 (1.49–4.77)	2.77 (1.54–4.99)	0.56 (0.27–1.59)	0.59 (0.28–1.25)
Obesity (yes vs no)	2.10 (0.50–8.87)			
Level of difficulty				
Simple	1	1	1	1
Moderate	2.7 (1.23–5.95)	2.84 (1.26–6.40)	1.96 (1.10–3.48)	1.88 (1.02–3.43)
Complex	7.66 (3.18–8.46)	8.59 (3.38–1.81)	6.73 (3.50–12.94)	7.64 (3.7–15.74)

[a]aOR = adjusted odds ratio; cOR = crude odds ratio.

Table 5.
Variables Associated With Conversion to Laparotomy and Failed Laparoscopies in Gynecologic Laparoscopies: Logistic Regression Analysis

	Conversion to Laparotomy		Failed Laparoscopy	
Variables	**cOR[a] (95% CI)**	**aOR[a] (95% CI)**	**cOR (95% CI)**	**aOR (95% CI)**
Age group				
<30 y	1	1	1	1
30–64 y	2.75 (0.96–7.84)	2.07 (0.69–6.21)	0.92 (0.55–0.52)	0.62 (0.36–1.08)
>64 y	2.95 (0.32–26.90)	1.66 (0.17–15.77)	2.21 (0.73–0.69)	0.75 (0.21–2.62)
Period of study				
2000–2002				
2003–2005	1	1	1	1
2006–2008	1.26 (0.53–2.97)	0.91 (0.37–2.26)	0.93 (0.52–1.64)	0.69 (0.38–1.24)
2009–2012	1.93 (0.86–4.33)	0.88 (0.36–2.14)	1.54 (0.91–2.59)	0.72 (0.40–1.30)
Prior abdominal surgery (yes vs no)	2.37 (1.17–4.77)	2.35 (1.13–4.90)	2.02 (1.24–3.30)	2.17 (1.29–3.64)
Obesity (yes vs no)	2.86 (0.67–2.28)		8.20 (3.93–17.14)	7.04 (3.09–16.02)
Level of difficulty				
Simple	1	1	1	1
Moderate	5.90 (1.38–25.24)	12.25 (1.61–93.26)	2.49 (1.25–4.98)	2.52 (1.23–5.16)
Complex	22.56 (5.05–100.78)	47.14 (5.86–378.99)	9.93 (4.73–20.87)	10.81 (4.76–24.58)

[a]aOR = adjusted odds ratio; cOR = crude odds ratio.

laparotomy was necessary to manage the perforation. There were 4 cases of injury to the bladder; 1 was managed during laparoscopy. Among the severe bleeding complications, 1 great vessel injury occurred during insertion of the Veress needle into the abdominal cavity, and urgent laparotomy was required. There were 3 cases of serious infection that required further surgery.

One death occurred after laparoscopy. The patient was aged 66 years and had a diagnosis of ovarian cancer. Her general condition was poor, and laparoscopy was performed to obtain a biopsy specimen. She died of cardiac arrest during the immediate postoperative period.

Of note was the finding that obesity played an important role as a risk factor for failed laparoscopy. Women with obesity were 7 times as likely as women without obesity to require open surgery because laparoscopy could not be initiated ($P < .001$).

DISCUSSION

The frequency of major and minor complications according to our data (1.96%) is within the range of values reported in earlier studies, that is, between 0.2% and 3%.[5,9–11,14,15] The results of this study provide evidence that both the degree of difficulty of the operation and prior abdominal surgery are variables that increase the risk of complications during gynecologic laparoscopy, as noted by other authors.[9,10,16]

Johnston et al[5] reported a rate of major complications of 0.6%, considerably lower than our rate (about one-third as high), a difference that may be due to the fact that patients in their study were treated at a center staffed by surgeons who were highly experienced in laparoscopic surgery (between 8 and 16 years of experience), and greater experience is a variable known to be closely related to lower percentage rates of complications.[6–9,11]

The indications for laparoscopic surgery in our study differed from those in other recent reports,[5,13] in which a larger proportion of laparoscopies were technically complex according to our classification. It should be noted that the data for our study cover a prolonged period of observation (12 years) and that, when laparoscopic surgery was introduced at our center, most procedures were technically simple to perform. Our data are similar to the results published by Chapron et al[9] in a French multicenter study of 29 966 laparoscopies.

Table 6.
Summary of Major Complications

Site of Lesion	Type of Surgery	Diagnosis	Surgical Access	Risk Factors
Intestinal perforation (n = 10)				
Rectum	LAVH[a]	Postop[a]	LPT[a]	Prior surgery
Ileum	TEC[a]	Postop	LPT	—
Ileum	Adnexectomy (endometriosis)	Postop	LPT	Prior surgery
Jejunum	LAVH	Postop	LPT	—
Sigmoid	Adnexectomy (endometriosis)	Intraop[a]	LPT	—
Rectosigmoid	Salpingectomy (salpingitis)	Intraop	LPT	Prior surgery
Ileum	Cystectomy + adhesiolysis	Postop	LPT	Prior surgery
Ileum	Adnexectomy + adhesiolysis	Postop	LPT	Prior surgery
Ileum	Bilateral adnexectomy	Postop	LPT	Obesity
Sigmoid	Unilateral adnexectomy	Intraop	LPT	—
Bladder injury (n = 4)				
Bladder	TEC	Postop	Surgery at another center	Prior surgery
Bladder	Cystectomy and exeresis of prevesical nodule	Intraop	LPS[a]	—
Bladder	Total hysterectomy	Postop	LPT	Prior surgery
Bladder	Subtotal hysterectomy	Intraop	LPT	—
Severe bleeding complications (n = 37)				
Vena cava lesion in 1	Adnexectomy (endometriosis)	Intraop	LPT	—
Other bleeding complications in 36	5 simple surgical procedures (13.9%)	—	11 by LPT (30.5%)	12 prior surgical procedures (33.3%)
	21 moderately difficult surgical procedures (58.3%)		25 by LPS (69.5%)	
	10 complex surgical procedures (27.8%)			
Serious complications from infection (n = 3)				
Wall abscess	Diagnostic LPS	Postop	LPT	Obesity
Pelvic abscess	Cystectomy	Postop	LPT	
Vaginal vault abscess	Total hysterectomy	Postop	Vaginal drainage	
Acute pulmonary edema (n = 1)	Salpingectomy for ectopic pregnancy			After transfusion
Death (n = 1)	LPS with biopsy			Peritoneal carcinomatosis

[a]LAVH = laparoscopy-assisted vaginal hysterectomy; LPS = laparoscopy; LPT = laparotomy; Postop = postoperative; Intraop = intraoperative; TEC = tubal electrocoagulation.

With time, laparoscopic procedures have become widely used at our center and our surgeons have acquired more experience. As a result, complex laparoscopic procedures have been performed more frequently, and in the final 4-year period of study, simple operations accounted for 10.5% of all cases, moderately difficult procedures for 70.1%, and complex procedures for 19.4%, whereas in the previous period, the rates were 45.2%, 49.4%, and 5.4%, respectively.

Complications are closely related to the level of difficulty of the operation: complex procedures had an 8-fold higher risk of serious complications and a 7-fold higher risk of minor complications compared with technically simple procedures. This finding is consistent with results published by Magrina,[8] Chapron et al,[9] and Leonard et al.[10] The likelihood of conversion and failed laparoscopy was also related to the level of technical difficulty.

In addition, we found that patients with prior abdominal surgery were twice as likely to have major complications compared with patients without this antecedent. The difference between patients can be explained by the presence of abdominal and pelvic adhesions that make surgery more difficult.[11,16–18]

We found no relationship between morbid obesity and major or minor complications, although the bivariate analysis indicated a trend toward a higher percentage of complications in patients with morbid obesity. Other authors who studied obesity as a risk factor also failed to find that complications during laparoscopy were more frequent in patients with obesity compared with patients with a normal body weight.[19]

Obtaining pneumoperitoneum and inserting the trocars form part of laparoscopy and should not be considered "less important" techniques, given that a non-negligible percentage of complications can occur during these procedures. Occasionally, these complications can be dramatic, as when a great vessel is damaged.[20,21] Among the laparoscopies studied in this article, we found 1 case of great vessel injury (vena cava) during entry (0.03%), which required urgent laparotomy to be brought under control.

It is important for major complications to be diagnosed promptly during laparoscopy so that corrective measures can be taken intraoperatively.[9,11] In this study only 3 of the 10 intestinal perforations were diagnosed intraoperatively, and the other cases were diagnosed during the early or late postoperative period. The 7 postoperative diagnoses may have been due to the fact that some visceral injuries occurred secondarily to intestinal, bladder, or ureter necrosis as a result of heat injury.[9]

The risk of conversion to laparotomy increases with the level of difficulty of surgery and can be up to 45-fold higher for complex procedures than for simple procedures. A likely explanation is that the higher frequency of complications during complex operations obliges surgeons to reconvert to laparotomy more often to manage these event.[10,11]

Failed laparoscopies are more frequent among patients with prior abdominal surgery or obesity, as well as patients who need complex surgery. In patients who have had previous operations, greater difficulty with access or surgical maneuvers is to be expected because of adhesions, as other authors have noted.[11,16,18] In addition, establishing access and performing subsequent surgical maneuvers in patients with morbid obesity are difficult when the Trendelenburg position for surgery is required because of potential difficulties with airway pressure.

The risk of complications did not decrease with time during our study period, as we would expect because of increased knowledge of laparoscopy techniques and operator proficiency. The reason for this unexpected finding may be that laparoscopy is being indicated for increasingly complex treatments.

Laparoscopic surgery was a safe procedure in the cases we analyzed at our center, but it is not without risks of serious complications, of which the surgeon should be aware. Technical difficulty and prior abdominal surgery were associated with the appearance of complications; in light of this finding, each patient should be evaluated individually, and surgeons should adapt the procedure and their technical skills to the circumstances particular to each patient.

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