










ORIGINAL ARTICLE

Short-term surgical outcomes of laparoscopic gastrectomy in a high-volume center: 10-year experience

Caracterización de los desenlaces quirúrgicos a corto plazo en gastrectomía por laparoscopia en un centro de alto volumen: 10 años de experiencia

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Abstract

Introduction. Gastric cancer in Colombia is the second most common neoplasm in men and the fourth in women. In recent years, the benefits of the laparoscopic approach in gastric cancer against bleeding, postoperative recovery and complications have been widely described, without affecting oncological results.

Methods. Retrospective observational study of patients undergoing laparoscopic gastrectomy at the Clínica Universitaria Colombia over a period of ten years between 2013 and 2023. Perioperative results were described in terms of hospital stay, operative bleeding, duration of the procedure, complications, causes of reintervention, and mortality in the first 30 days.

Results. 418 patients were included, 58.9% men, with an average age of 60.88 years. An average surgical time of 228.7 minutes was documented, with a blood loss of 150 ml. The mean number of lymph nodes resected was 26.1 ± 11.4. The average hospital stay was 4 ± 4 days, and complications were recorded in 104 subjects, with an average rate of 24%, of which 29 (27.4%) obtained a Clavien-Dindo IIIB classification.

Conclusions. Laparoscopic gastrectomy in a high-volume center and with experienced surgeons in Colombia has perioperative results similar to those reported in the world literature. Studies with greater strength of association are still required to establish recommendations on the routine use of this approach in advanced malignant pathology.

Keywords: gastric neoplasms; gastrectomy; laparoscopy; minimally invasive surgical procedures; postoperative complications; mortality.

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Resumen

Introducción. El cáncer gástrico en Colombia es la segunda neoplasia más común en hombres y la cuarta en mujeres. En los últimos años se han descrito ampliamente los beneficios del abordaje laparoscópico en el cáncer gástrico frente a sangrado, recuperación postoperatoria y complicaciones, sin afectar los resultados oncológicos.

Métodos. Estudio observacional retrospectivo, de pacientes llevados a gastrectomía laparoscópica en la Clínica Universitaria Colombia durante un periodo de diez años, entre 2013 y 2023. Se describieron los resultados perioperatorios en cuanto a estancia hospitalaria, sangrado operatorio, duración del procedimiento, complicaciones, causas de reintervención y mortalidad en los primeros 30 días.

Resultados. Se incluyeron 418 pacientes, 58,9 % hombres, con una edad promedio de 60,88 años. Se documentó un tiempo quirúrgico promedio de 228,7 minutos, con un sangrado de 150 ml. La media de ganglios linfáticos resecaos fue de $26,1 \pm 11,4$. La estancia hospitalaria en promedio fue de 4 ± 4 días, y se registraron complicaciones en 104 sujetos, con una tasa promedio de 24 %, de las cuales 29 (27,4 %) obtuvieron una clasificación Clavien-Dindo IIIB.

Conclusiones. La gastrectomía por laparoscopia en un centro de alto volumen y con cirujanos experimentados en Colombia, tiene resultados perioperatorios similares a lo reportado en la literatura mundial. Aún se requiere de estudios de mayor fuerza de asociación para establecer recomendaciones sobre el uso rutinario de este abordaje en patología maligna avanzada.

Palabras clave: neoplasias gástricas; gastrectomía; laparoscopia; procedimientos quirúrgicos mínimamente invasivos; complicaciones posoperatorias; mortalidad.

Introduction

Worldwide, gastric cancer causes 5.6% of new cancer cases (1,089,103) and 7.7% of deaths (768,793). In 2020, the WHO estimated that gastric cancer in Colombia was the main cause of cancer mortality¹. In Colombia, the main indication for performing gastrectomies is malignant disease, since gastric cancer is the second most common neoplasm in men and the fourth most common in women².

Since 1926 there have been two clear indications for performing gastrectomy: cancer and the treatment of peptic ulcer and its complications. At that time, the Devine technique and Billroth I and Billroth II reconstructions of the gastrointestinal tract were already common³. Before the arrival of minimally invasive surgery, gastrectomy complications reached 24%, therefore, it was used as a last resort when other procedures were not sufficient⁴.

Laparoscopic gastrectomy was first described in 1994 in Japan in a case of early gastric cancer⁵, although other data suggest that the first laparoscopic gastrectomy was performed in 1992 by

Peter Goh in Singapore with reconstruction type Billroth II for a patient with acid-peptic disease⁶. Since then, surgical outcomes have improved substantially. Zia et al., evaluated 61 patients undergoing laparoscopic gastrectomy in benign and malignant disease over 4 years, finding an overall mortality of 1.7% with a follow-up of 48 months and a morbidity of 3.5% associated with the procedure⁷.

A 50-year experience, published in 1991, with 2,633 individuals allowed us to recognize that, despite the high morbidity of the procedure, survival met the life expectancy standard⁸. In the last two decades of the 20th century, reports of clinical experiences were published, such as that of the Ulm hospital in Germany, who described a population of 484 patients over a period of 15 years with a perioperative mortality of 13.4% and a survival 5-year global 15.9%. Bittner conclusion was that the improvement in outcomes is a consequence of standardizing a surgical technique⁹.

Between 1993 and 2013 in the United States, 318,788 gastrectomies were performed, 58% (184,805) for malignant pathology, while 42%

(133,983) were for benign disease. Subtotal gastrectomies were more frequent, with a total of 232,670, compared to total gastrectomies, which reached 67,342¹⁰.

The MAGIC study in 2006 showed that perioperative chemotherapy improved oncological results in patients with gastric cancer, in terms of survival, without representing a greater significance in surgical morbidity¹¹. Currently, this concept persists for locally advanced stages, using more frequently the scheme proposed in the FLOT4 study (fluorouracil, leucovorin, oxaliplatin, and docetaxel), which demonstrated even better survival and disease-free times^{12,13}.

Likewise, it has been shown that lymphadenectomy is a surgical standard and lymph node count is a predictor of surgical quality. Obtaining at least 12 lymph nodes is a requirement in terms of oncological gastrectomy. At least 3 resectable lymph node levels have been described, D1 (nodal levels 1 to 6), D2 (levels 1-12) or D3 (levels 1-16); D2 lymphadenectomy originally included a distal pancreatectomy and splenectomy, but a Dutch study demonstrated increased associated morbidity, with no change in mortality. This has led to modifying lymphadenectomy to dispense with these two procedures (level 10) and only resect the proximal nodes of the splenic artery (level 11p)¹⁴.

In relation to the chemotherapy management of oncological gastric pathology, the CLASSIC study (Capecitabine and Oxaliplatin Adjuvant Study in Stomach Cancer) evaluated the benefits of adjuvant chemotherapy after radical surgery with D2 dissection in the setting of stage II/III gastric cancer, and documented a clear benefit of this intervention, managing to impact survival, compared to D2 surgery alone, with a 5-year survival of 68% and 53%, respectively¹⁵.

In recent years, multiple studies have been published comparing the results of open and laparoscopic gastrectomies^{16,17}; however, the data in Colombia are very limited¹⁸. Therefore, it was considered essential to identify the population characteristics and surgical results of individuals

who undergo laparoscopic gastrectomy, in an area in which local literature is still scarce.

Methods

Patients and variables

A retrospective observational cohort study was carried out on patients undergoing laparoscopic gastrectomy in a highly experienced center during a period between 2013 and 2023. The procedures were performed by surgeons with more than 5 years of experience in gastrectomies. Patients of legal age, with benign and malignant pathologies, undergoing surgery with a laparoscopic approach, performed urgently or scheduled, were included. Patients who were pregnant, lost to follow-up in the first 30 days, or without complete information on the variables studied were excluded.

The review of medical records was carried out individually by the researchers using the medical record management systems SOPHIA version 7.0.4 for hospitalization data, and AVICENA version 7.11.10 for outpatient history, with audit by a second researcher. Data were recorded anonymously in the REDcap data collection system.

Surgical technique

The group of gastrointestinal surgeons at our center standardized the surgical technique used since 2015. The five surgeons in the group systematically perform the same steps in all cases. The particularities of our surgical technique include:

- Use of three 12 mm trocars, supraumbilical, right and left paramedian; use of two 5 mm trocars, subxiphoid and left flank.
- Use of advanced bipolar or ultrasonic energy systems.
- Total omentectomy is routinely performed.
- Lymphadenectomy includes the nodes of the hepatic artery, splenic artery, celiac trunk, and hepatoduodenal ligament.

- The alimentary loop is sectioned 50 cm from the ligament of Treitz and ascended antecolic.
- In total gastrectomy, an L-L esophagojejunostomy is performed in Pi (π) described by Xing *et al.*¹⁹. In subtotal, the rod of the alimentary loop is positioned towards the lesser curvature (antiperistaltic) to prevent stenosis of the anastomosis due to the closure of the enterotomy in this loop. Both anastomoses are performed with 60 mm mechanical suture.
- In total gastrectomy, a methylene blue test is performed on both anastomoses.

Statistical analysis

The IBM® SPSS program (IBM Corp., Armonk, USA) was used for statistical analysis. In the continuous variables, descriptive measures were calculated as mean and standard deviation. These measures provide a general understanding of the central tendency and dispersion of the observed values in the data set. As for the discrete variables, they were analyzed individually by determining frequencies

and percentages. In addition, frequency tables and graphs were used to clearly and concisely present the distribution of these variables. Finally, an independent samples test was performed to evaluate possible statistical associations.

Results

During the observation period, approximately 38 gastrectomies were performed per year, with a range between 6 and 61. A positive cumulative trend was evident over the years (Figure 1).

After reviewing medical records, 418 patients were included, a sample represented by 58.9% men and 41.2% women. The average age was 60.88 ± 14.1 years. Of these patients, 52.2% had a normal nutritional status by body mass index (BMI) and only 6.0% were classified as underweight (Table 1).

The main diagnosis for which patients underwent gastrectomy was gastric adenocarcinoma, with intestinal histological differentiation in 51.4%, followed by diffuse adenocarcinoma with signet ring cells in 13.2%. In total, laparoscopic gastrectomies were for adenocarcinoma

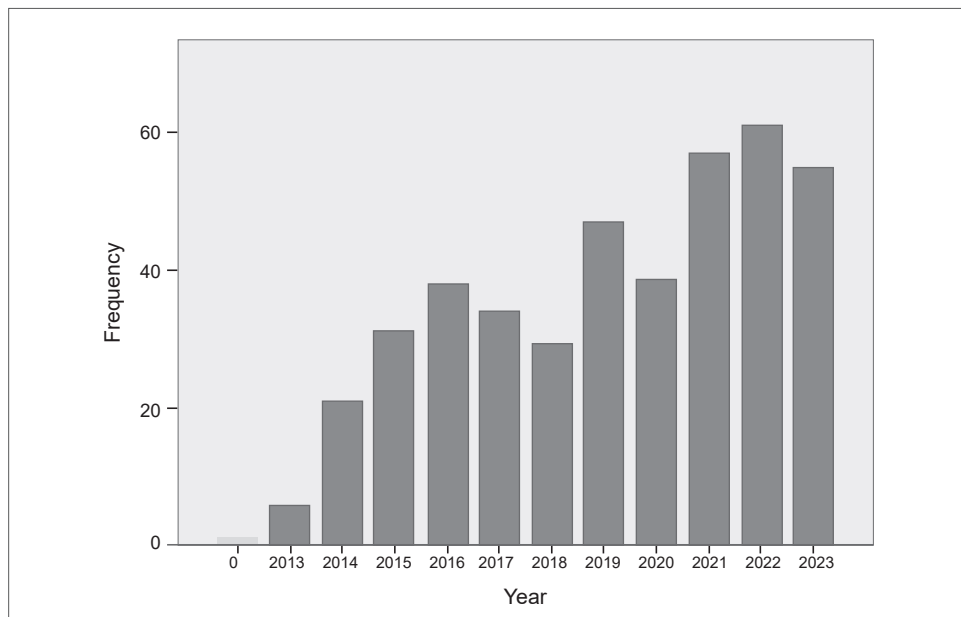


Figure 1. Distribution of gastrectomies during the observation period. Clínica Universitaria Colombia, Bogotá, Colombia.

Source: Authors' own elaboration.

Table 1. General characteristics of the patients studied.

Variable	n	%
Age in years (media, SD)	60.88	14.1
Sex		
Female	172	41.2
Male	246	58.9
Nutritional status according to BMI		
Underweight	25	5.98
Normal	218	52.2
Obesity	47	11.2
Overweight	128	30.6
Histological diagnosis		
Intestinal adenocarcinoma	215	51.4
Diffuse adenocarcinoma with signet ring cells	55	13.2
Gastric GIST	45	11.0
Diffuse adenocarcinoma	24	5.74
Intestinal adenocarcinoma with signet ring cells	16	3.83
Mixed adenocarcinoma	11	2.63
High grade dysplasia	11	2.63
Poorly differentiated adenocarcinoma	11	2.63
Neuroendocrine tumor	7	1.67
Mixed adenocarcinoma with signet ring cells	6	1.44
Mucinous adenocarcinoma	6	1.44
Gastric lymphoma	5	1.20
Poorly differentiated adenocarcinoma with signet ring cells	2	0.48
Acid-peptic disease (benign stricture)	2	0.48
Schwannoma	2	0.48
Complete pathological response (n, %)	35	8.36
Neoadjuvant (n, %)	231	55.3
Neoadjuvant chemotherapy regimen (n, %)		
FLOT	151	65.9
Other	78	34.1
Elective surgery (n, %)	395	94.5
Type of gastrectomy (n, %)		
Total	226	54.0
Subtotal	160	38.2
Atypical	32	7.65
Reconstruction (n, %)		
Roux-en-Y	349	83.49
None	31	7.41
Billroth II	30	7.17
Billroth I	6	1.34
Others	2	0.47

SD: standard deviation; BMI: body mass index; GIST: gastrointestinal stromal tumor.
Source: Authors' own elaboration.

in 346 patients (82.8%). Among the remaining 13.1% with other tumors, there were 45 cases (11%) of stromal tumors (GIST), seven gastric neuroendocrine tumors (1.7%), and two schwannomas (0.5%). For patients with lymphoma or stenosis due to acid peptic disease, the surgical indication was given by the patient's symptoms and response to the first lines of management. On the other hand, 12 of the subjects required conversion to open surgery.

In total, 231 subjects received neoadjuvant therapy, and of these, 65.9% were under the FLOT scheme, this being the current perioperative chemotherapy scheme in our patients, established since 2017. Previously the most used, according to the characteristics of the patients, it was the MAGIC scheme.

According to the classification of the American Joint Committee on Cancer (AJCC) edition 8, 23.0% of the subjects were in oncological stage IA, followed by 13.1% in oncological stage IIIA (Table 2).

An average surgical time of 228.7 minutes was documented, with a blood loss of 150 ml and an interquartile range of 195 ml. When performing a stratified analysis of the subgroups, a longer surgical time was quantified in total and

subtotal gastrectomies compared to atypical gastrectomies, as well as in the surgical bleeding variable.

Without a doubt, one of the indicators of adequate technique in oncological surgery is lymph node dissection, specifically the lymph node count in the surgical specimen. When analyzed during the 10 years of the group, it is observed that in the first years the median was lower than the current one, with an exponential growth in the final number of nodes in cases of D2 dissection. Finally, the mean lymph node resection was 26.1 ± 11.4 (Table 3), with isolated cases of suboptimal dissection in patients undergoing palliative or non-oncological surgery.

Sixty-one patients (16.4%) required postoperative transfer to the intensive care unit (ICU), with a mean length of stay for all gastrectomies of 0.4 ± 3.32 days. The direct impact on ICU stay is found in the rapid recovery strategies implemented since 2015-2016. In addition to this, patients with anastomotic leak, significant comorbidities, and severe infections required ICU management. The average hospital stay was 4 ± 4 days, being longer in patients with total gastrectomy (average of 5 days) compared to subtotal (4 on average) and atypical gastrectomy (average of 1 day).

Table 2. pTNM classification and oncological stage.

pT			pN			pM			Oncological stage		
Category	n	%	Category	n	%	Category	n	%	Category	n	%
0	38	10.8	0	198	47.4	0	333	79.7			
1A	24	6.8	1	52	12.4	1	18	4.3	IA	96	23.0
1B	41	11.6							IB	40	9.6
2	58	16.5	2	45	10.7				IIA	50	11.9
									IIB	46	11.0
3	95	27.1	3	23	5.5				IIIA	55	13.1
									IIIB	39	9.3
									IIIC	8	1.9
									IV	17	4.1
4A	77	21.9									
4B	13	3.7									
is	5	1.4									

Table 3. Outcomes according to the type of gastrectomy.

Variable	Type of gastrectomy								p-value
	All (n=418)		Total (n=226)		Subtotal (n=158)		Atypical (n=33)		
Surgical time, minutes (media, SD)	228.7	65.8	255.4	55.1	215.8	52.4	115	44.3	0.000
Bleeding, ml (mediana, RIC)	15	195	200	200	150	180	50	37.5	0.000
Lymph nodes in pathology (media, SD)	26.1	11.4	26.7	11.4	25.1	11.4	30	4.24	0.29
Conversion to open surgery (n, %)	12	2.87	7	3.10	5	3.1	0	0.00	0.59
Postoperative ICU (n, %)	61	14.6	44	19.5	16	10.1	1	3.10	0.005
Days of stay in ICU (media, SD)	0.74	3.32	1.07	4.18	0.31	1.21	0.63	3.53	0.07
Complications (n, %)	104	24.9	70	31.0	33	20.8	1	3.10	0.000
Clavien-Dindo classification (n, %)									
1	18	16.9	9	12.2	9	29.0	0	0.00	-
2	16	15.1	32	16.2	4	12.9	0	0.00	
3A	15	14.2	15	20.3	0	0.00	0	0.00	
3B	29	27.4	20	27.0	9	29.0	0	0.00	
4A	7	6.6	4	5.40	3	9.70	0	0.00	
4B	6	5.66	4	5.40	2	6.50	0	0.00	
5	14	13.5	10	13.5	4	12.9	1	100	
Anastomotic leak (n, %)	39	9.33	35	15.5	2	1.30	2	6.20	0.000
Surgical site infection (n, %)	48	11.5							
Superficial	11	2.63	7	18.9	4	40.0	0	0.00	-
Organ-space	37	8.85	31	81.1	6	60.0	2	100	
Days of hospital stay (median, IQR)	4	4	5	5	4	2	2	1	0.000
Reintervention (n, %)	51	12.2	34	15.0	16	10.1	1	3.1	0.08
Reintervention for fistula (n, %)	28	6.69	26	6.22	2	0.47	0	0.00	0.18
30-day mortality (n, %)	14	3.35	9	4.00	4	2.50	1	3.00	0.73
Follow-up (n, %)	401	96.2	216	96.0	153	96.2	31	96.9	0.90

SD: standard deviation; IQR: interquartile range; ICU: Intensive care unit.

Source: Authors' own elaboration.

Complications were recorded in 104 subjects, with an average rate of 24%, of which 70 (31%) correspond to the total gastrectomy group and 33 (20.8%) to the subtotal gastrectomy group. The Clavien-Dindo scale was used to measure the severity of complications, of which 29 (27.4%) obtained a Clavien-Dindo IIIB classification (Figure 2). Clavien-Dindo III complications were mainly due to anastomotic leak, in addition to isolated pleural effusion requiring thoracentesis. Early reinterventions had a frequency of 12.2%, of which half were secondary to leak. Hemoperitoneum was also identified in three patients and loop kinking or obstruction distal to the anastomosis in three more cases.

In total, 39 (9.3%) cases of anastomotic leak were documented, 35 (15.5%) in the total

gastrectomy group, with a statistically significant association ($p=0.000$). Also, there were 48 episodes of surgical site infection (SSI), of which 11 (2.6%) corresponded to a superficial incisional SSI and 37 (8.8%) were organ-space type.

It was found that neoadjuvant therapy had a statistically significant association ($p<0.05$) with longer surgical time, greater surgical bleeding, and anastomotic leak (Table 4).

Discussion

The Clínica Universitaria Colombia, in Bogotá, Colombia, where the study was carried out, is a high-volume center for upper gastrointestinal pathology, where between 60 and 70 gastrectomies are currently performed each year. As a surgical

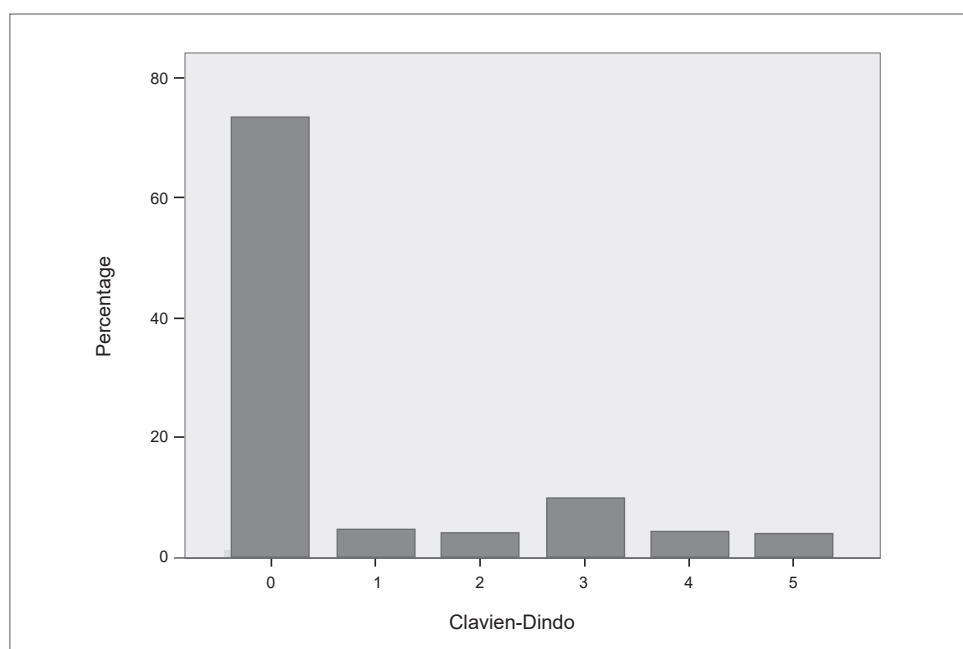


Figure 2. Frequency of complications according to the Clavien-Dindo classification.
Source: Authors' own elaboration.

Table 4. Outcomes according to neoadjuvant therapy.

Variable	Neoadjuvant					p-value	
	Todos (n=418)		No (n=187)		Yes (n=231)		
Surgical time, minutes (media, DE)	228.7	65.8	200	67.1	251.1	55.2	0.000
Bleeding, ml (mediana, RIC)	15	195	100	150	200	200	0.000
Lymph nodes in pathology (media, SD)	26.1	11.4	25.0	11.6	26.6	11.2	0.22
Conversion to open surgery (n, %)	12	2.8	3	1.6	9	3.9	0.16
Postoperative ICU (n, %)	61	14.6	27	14.4	34	14.7	0.93
Days of stay in ICU (media, SD)	0.7	3.3	0.9	4.4	0.5	2.03	0.22
Complications (n, %)	104	24.9	43	23	61	26.4	0.42
Clavien-Dindo classification (n, %)							
1	18	16.9	9	20.9	9	14.3	
2	16	15.1	8	18.6	8	12.7	
3A	15	14.2	4	9.3	11	17.5	-
3B	29	27.4	9	20.9	20	31.7	
4A	7	6.6	2	4.7	5	7.9	
4B	6	5.6	3	7	3	4.8	
5	14	13.5	7	16.2	7	11.1	
Anastomotic leak (n, %)	39	9.3	8	4.2	31	14.5	0.001
Surgical site infection (n, %)	48	11.5	14	7.5	34	14.7	0.021
Superficial	11	2.6	6	42.9	5	14.7	
Organ-space	37	8.8	8	57.1	29	85.3	
Days of hospital stay (median, IQR)	4	4	4	3.5	4	4	0.003
Reintervention (n, %)	51	12.2	19	10.2	32	13.9	0.25
Reintervention for fistula (n, %)	4	0.9	1	0.5	3	1.3	0.42
30-day mortality (n, %)	14	3.3	7	3.7	7	3	0.69
Follow-up (n, %)	401	96.2	178	95.7	223	96.5	0.65

SD: standard deviation; IQR: interquartile range; ICU: Intensive care unit.

Source: Authors' own elaboration.

group, training in laparoscopic surgery has had exponential growth, with important changes in the last 10 years regarding the perioperative management of the patient, which undoubtedly directly impacts oncological and surgical results.

The gastroesophageal surgery group has managed to form a multidisciplinary team, where pathology, physical therapy, respiratory therapy, nutrition and psychology play a fundamental role in recovery. Around 2015, nutritional support, fast track, prehabilitation and comprehensive rehabilitation strategies were implemented, directly impacting the length of hospital stay and postoperative recovery, as described in world literature. The results of this study regarding the characterization of the population of patients taken to surgery are similar to those recently reported by Hoyos in the Colombian Caribbean and Jurado in Medellín, in terms of distribution by sex and age^{20,21}. In the department of surgery of the Royal College of Surgeons in Dublin, Ireland, they developed a systematic review that included studies with a prospective and randomized design in patients with primary gastric tumor, adding a total of 6890 patients, 46.6% taken to surgery for open approach, 49.6% by laparoscopy and 3.7% assisted by robot. The analysis did not demonstrate inferiority of surgical and oncological results in the setting of patients with early gastric cancer undergoing minimally invasive procedures²².

Likewise, in Latin America, in 2014, Malet et al., reported in a hospital in Uruguay a series of cases of laparoscopic gastrectomy, showing that it is possible to guarantee oncological results comparable to conventional open surgery in terms of lymphadenectomy and R0 resection²³.

Both retrospective and randomized studies have shown that lymph node count and disease-free period do not change when comparing open and laparoscopic approaches^{24,25}. The average hospital stay reported in the literature for patients with cancer was 12.6 to 18.2 days, while in benign disease it was longer, with a range of 15.5 to 19.2 days, and in-hospital mortality was between 11.9 and 5.9%²⁶. In our patients, the average hospital stay was 4 ± 4 days, with an average ICU stay of

less than one day, lower than that reported in other Colombian studies^{20,21}.

Lou et al. carried out a meta-analysis of randomized clinical trials in the setting of gastric cancer, in which they obtained a total of 7,643 patients, among whom the laparoscopic approach was associated with a lower rate of bleeding, a lower rate of complications and early recovery. However, in that study this approach was related to a longer surgical time and a lower number of nodes obtained²⁷.

The study by Choi et al., which has a cohort of around 10,000 gastrectomies for gastric cancer performed by the same surgeon, 69.8% of the patients were taken to subtotal gastrectomy, with an average number of 42.3 lymph nodes obtained²⁶. In our study, the mean lymph node resection was 26.1 ± 11.4 , a result of the standardization of our technique, as well as the complete report of the final pathology, as a consequence of the integration with the pathology service in the last 5 years, managing to have close communication and a select group of pathologists for gastrointestinal tumors.

Among the patients published by Choi et al.²⁶, the most common tumor stage was I (50.1%) and the least common was IV (4.5%), similar to what was published by the group from the National Cancer Institute of Bogotá, Colombia²⁸, while in our study only 23.0% of the subjects were located in oncological stage IA.

Total omentectomy is a controversial topic in the management of gastric cancer. In recent years, the results of 3 meta-analyses have shown no inferiority of partial versus total omentectomy in gastric cancer. However, most of the studies included in these meta-analyses are retrospective cohorts and there are very few randomized studies²⁹⁻³¹. Our group performs routine omentectomy, with an average bleeding of 213 ml, which is in line with the world literature³².

A 2015 meta-analysis, prepared by the Cochrane collaboration, collected 2,794 patients with gastric cancer in 13 clinical trials and compared open gastrectomy with laparoscopic gastrectomy, finding that there were no

statistically significant differences in 30-day mortality, or short or long-term adverse events³³. However, another more recent meta-analysis by Hakkenbrak *et al.*, based on 22 randomized clinical trials, demonstrated results in favor of the laparoscopic approach in terms of less intraoperative blood loss and a subsequent faster recovery of the patient, without inferiority in the number of nodes collected in lymphadenectomy³⁴.

The multicenter randomized study CLASS02 in 2020, showed that there is no inferiority in terms of mortality between the laparoscopic and open approaches, with a surgical time without statistically significant differences and complications close to 20%, considering laparoscopic surgery safe³⁵. The operating time is usually longer in the laparoscopic approach, and in our study it was 229 minutes. Even so, the study by Etoh *et al.* reported a lower rate of complications in this group of patients³⁶.

In the laparoscopic approach, a conversion rate to open surgery of 14.5%, intraoperative complications of 1.4%, incidence of duodenal fistula of 3.6% and reinterventions in 7.3% have been described. In our study we estimate a 26.7% complication rate, which is above the world literature, but may correspond to the regional environment, taking into account that the report of any event that altered the course of the expected postoperative evolution was considered a complication. For this reason, the number of patients with Clavien-Dindo classification I and II was not negligible, among whom nausea and emesis were mainly identified, as well as any factor that altered the course of evolution and postoperative recovery. When reviewed in this way and compared to high-volume institutions with groups of excellence, the complete reporting of complications was adequate and allowed impact on medical management strategies or early identification of complications that require early additional management.

Anastomotic leak is one of the most serious complications of gastrectomy, even more so in total gastrectomy. We found an association between advanced clinical stage and the use of

perioperative chemotherapy as risk factors for its presence. We consider that this is because patients with advanced stages are taken to perioperative chemotherapy and both factors increase the risk of anastomotic leak.

Among our patients with complications, there were two laparoscopies without positive findings, which indicates that one of the points of continuous improvement and strict work of the group includes the early detection of complications and imaging or laparoscopic evaluation of them, in order to impact on the reduction of mortality, hospital stay time and improve the postoperative recovery of our patients.

Laparoscopic gastrectomy had been validated in multiple studies of varying statistical power in early stages of gastric cancer. Since 2013, there has been evidence from the Asian continent on laparoscopic gastrectomy in advanced stages³⁷ and in recent years, studies on this topic from the West have been published^{38,39}. Likewise, it has been shown that in patients with a locally advanced stage there are no differences regarding disease-free time when the open and laparoscopic approach is compared at 3 years, with a rate of 76.5 and 77.8%, respectively, establishing itself as not inferior⁴⁰.

In May 2023, the Japanese study by Etoh *et al.*, with 502 patients in advanced stages of gastric cancer, randomized into two groups of laparoscopic and open gastrectomy, demonstrated non-inferiority of the laparoscopy group, with similar findings in major complications, mortality, overall survival (Hazard Ratio 0.83; 95% CI 0.57 - 1.21) and disease free at 5 years (73.9%; 95% CI 68.7% - 79.5%)³⁶.

By 2022, the clinical trial by Huang *et al.*, which included a total of 1016 patients undergoing subtotal gastrectomy in 14 centers in China, randomized 1:1 into open and laparoscopic surgery, showed that the rate of 5-year survival was similar between the two groups of patients with locally advanced gastric cancer. However, none of the patients were taken to prior neoadjuvant treatment, which limits the analysis of the results¹⁶. This corresponds to other results, such as the KLASS-01 study carried out in Korea, which

estimated a survival time of up to 90% for the open approach, without inferiority in the laparoscopic approach⁴¹.

Over the years, laparoscopic gastrectomy has become the standard procedure in some specific situations. In GIST, laparoscopic gastrectomy has been established as the standard treatment, having a significant impact on reducing the size of the incisions, mitigating postoperative pain, minimizing postoperative adhesions and reducing hospital stay⁴². The approach of choice for resection of these lesions is wedge gastrectomy or non-anatomical resections, which are performed with curative intent. Taking into account that radical surgery for these cases should only guarantee a negative section margin, technically limited tumor resection can be performed, which does not mean that an anatomical gastrectomy is not the choice in many cases, due to technical consideration and functional in the context of each patient⁴².

In a study carried out between 2016 and 2020, which included a total of 126 individuals with GIST randomized into two groups of conventional gastrectomy and laparoscopic gastrectomy, it was shown that in the second group the operating time was shorter, intraoperative bleeding was reduced, and shorter hospital stay, compared to the conventional gastrectomy group⁴³.

Conclusions

This is a retrospective study, so the strength of association of the variables studied is low, however, it allows for the characterization of patients in our society and their behavior, as well as the identification of the different strategies that have impacted in oncological, surgical and postoperative recovery outcomes. The characteristics of our study do not have sufficient tools to give a recommendation regarding the relationship observed between the pathological stage and neoadjuvant therapy with anastomotic leak, nor is it the objective of the present study to demonstrate oncological results.

We consider that the perioperative outcomes of the last 5 years probably have a better impact when studied individually, once the gastrointes-

tinal surgery group has reached the necessary learning curve and a technique has been standardized institutionally. It is possible to affirm that the outcomes presented are comparable with other international studies of open gastrectomy, without inferiority in lymph node resection and days of hospital stay. It is necessary to openly know local, regional and national clinical experience to establish the influence of our surgical standards on the patient's perioperative period, with the possibility of building more and more evidence-based recommendations.

The creation of a group of excellence requires multidisciplinary teamwork, which is why it cannot be denied that when the common objective is recovery, well-being and conservation of oncological principles in patients with gastric cancer, surgeons must rely on services that play a fundamental role in achieving these objectives, such as nursing, nutrition, psychology, physical and respiratory therapy, anesthesiology and intensive care, among others.

Compliance with ethical standards

Informed consent: The current study was presented and accepted by the institutional ethics committee as a low-risk study, as it was a retrospective observational cohort study, in accordance with the guidelines of Resolution 008430 of 1993 of the Ministry of Health. For this reason, the completion of informed consent was not required.

Conflict of interest: The authors of the study have no conflicts of interest to declare, with the exception of Jorge Vargas who is an education advisor for Amarey and Nova-medical, but this condition did not affect the development of this research.

Use of artificial intelligence: No artificial intelligence (AI) systems were used to carry out the study or to prepare the manuscript.

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Author's contributions

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