CIRUGÍA ESPAÑOLA

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Original article

Gastric cancer and laparoscopy: analysis of data from the National Register of Laparoscopic Gastric Surgery

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ARTICLE INFORMATION

Article history:
Received September 12, 2008
Accepted October 2, 2008
Online April 16, 2009

Keywords:
National register
Laparoscopy
Gastric cancet

A B S T R A C T

Objective: To study the data from the Laparoscopic Gastric Surgery Spanish National Register of laparoscopic gastric surgery and to analyse the type of surgery, the conversion to laparotomy, postoperative complications, and mortality.

Patients and method: From March 2005 to July 2008, details of 302 laparoscopic gastric surgical interventions were sent to the Association of Spanish Surgeons web-site. Details of surgical technique, reconversion, clinical and pathological data, morbidity and mortality were collected and analysed.

Results: A total of 245 patients had gastric adenocarcinoma, 35 of them stromal tumours and 22 other gastric pathologies. In gastric adenocarcinoma patients, resection was performed in 232 cases (95%). The most frequent histology was intestinal, mainly located in the distal third of the stomach, with 34% of the tumours being locally advanced. D2 lymphadenectomy was performed in 117 cases, D1 in 105, and D0 in 6. Reconversion was needed in 21 cases (9%), with technical difficulty being the most frequent cause. Postoperative complications were reported in 72 patients (31%), with anastomotic leak being one of the most significant. Postoperative mortality was 6%, with sepsis due to anastomotic leak and cardiac or respiratory complications the most frequent causes. The mean hospital stay of patients without complications was 9.2 (3) days.

Conclusions: Laparoscopic gastrectomy for gastric cancer is a feasible but technically demanding procedure. Potential benefits of minimal invasive surgery can be reduced due to a high rate of postoperative complications

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Cáncer gástrico por laparoscopia: análisis de los datos del Registro Nacional de Cirugía Gástrica por Laparoscopia

Palabras clave:
Registro Nacional
Laparoscopia
Cáncer gástrico

RESUMEN

Objetivo: Describir los datos enviados al Registro Nacional de Cirugía Gástrica por laparoscopia y analizar el tipo de cirugía, la reconversión, las complicaciones postoperatorias y la mortalidad.

Pacientes y método: Desde marzo de 2005 a julio de 2008 han sido remitidos al registro 302 pacientes a través de un cuestionario ubicado en la página *web* de la Asociación Española de Cirujanos, donde se registraron datos clinicopatológicos, características de la cirugía realizada, reconversión y morbimortalidad.

Resultados: Se ha intervenido a 245 pacientes por adenocarcinoma gástrico, 35 por tumores estromales y 22 por otras afecciones. En los adenocarcinomas gástricos se realizó cirugía resectiva en 232 (95%) casos. La localización predominante fue el tercio distal y el tipo de tumor más frecuente, el intestinal. El 34% fue tumores localmente avanzados. Se realizó una linfadenectomía D2 en 117 casos, D1 en 105 y D0 en 6. Se realizó reconversión en 21 (9%), y entre las causas destacan las dificultades técnicas. Se han descrito complicaciones postoperatorias en 72 (31%) casos, entre las que destacan por su gravedad las fístulas digestivas. Hubo una mortalidad postoperatoria del 6%, y las causas más frecuentes fueron la sepsis por fuga anastomótica y las complicaciones cardiorrespiratorias. La estancia media hospitalaria en los pacientes que no presentaron complicaciones fue de 9,2 ± 3 días.

Conclusiones: La gastrectomía laparoscópica en el cáncer gástrico es un procedimiento factible que no está exento de dificultades técnicas. Una considerable tasa de complicaciones postoperatorias pueden llegar a condicionar los beneficios de la cirugía mínimamente invasiva.

Introduction

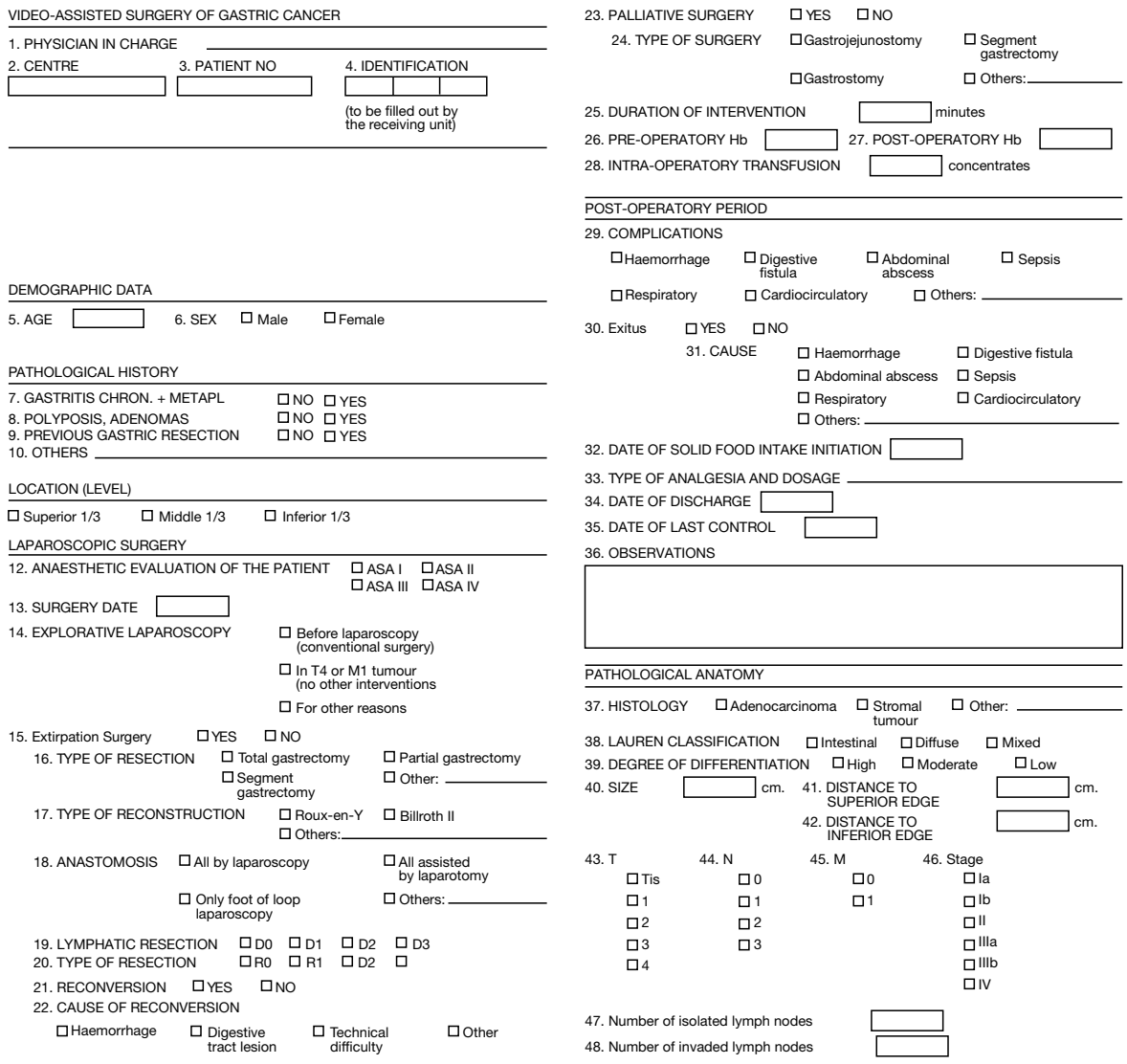
The introduction of minimally invasive techniques in digestive tumour surgeries has developed very differently for each kind of tumour. There are randomised clinical trials on colon cancer that demonstrate the advantages in the immediate post-operatory period of laparoscopic treatment, with oncologic results similar to those found using conventional long-term methods.[1] However, in other types of abdominal tumours there is still too little evidence of the effectiveness due to the fact that this type of procedure is less frequent, the technical complexity is greater and the biological characteristics are different. When faced with the difficulty to develop controlled prospective studies that would provide more scientific weight, and while waiting for such studies to be carried out, a series of national registries have been established regarding hepatic, pancreatic, oesophageal, and gastric laparoscopic surgery, auspicated by the different sections of the Spanish Surgeon's Association (AEC, in Spanish).[2,3] The information provided by the registries is especially useful in those cases where procedures are applied to a small number of patients as they are non-standardised techniques, in pathologies of little prevalence and in those where experience is limited to a small number of surgeons. This type of registry allows for the accumulation of a great quantity of information, whose analysis helps to identify technical problems and establish a series of recommendations to avoid them, as well as to determine the feasibility and the effectiveness of new techniques in the long term, especially in oncologic pathologies.

In 2005, the National Registry of Laparoscopic Gastric Cancer was started, sponsored by the sections of laparoscopic surgery and gastroesophageal surgery of the AEC. The goal of this study is to announce and analyse how this procedure has been developing in our hospitals.

Material and method

In March 2005, data collection regarding laparoscopic gastric surgery was begun using a questionnaire found on the AEC's webpage (www.aecirujanos.es/registros_cir_lap/reg_cir_lap_gastrica.php). All patients that had undergone surgery in any hospital found in national territory were included, regardless of previous experience, with the single requirement of having started the surgery by laparoscopy. After introducing each case, the data were sent to the registry coordinator to be analysed in a Microsoft Access 2003 database. The form included clinical information about the patients, aspects about the surgical technique used, anatomopathologic characteristics of the tumours, post-operatory evolution, morbidity, mortality and follow-up (Figure).

Up to July 2008, 302 patients operated on for different gastric conditions have been remitted, with 245 for



VIDEO-ASSISTED SURGERY OF GASTRIC CANCER

1. PHYSICIAN IN CHARGE
2. CENTRE
3. PATIENT NO
4. IDENTIFICATION
(to be filled out by the receiving unit)

DEMOGRAPHIC DATA

5. AGE
6. SEX ☐ Male ☐ Female

PATHOLOGICAL HISTORY

7. GASTRITIS CHRON. + METAPL ☐ NO ☐ YES
8. POLYPOSIS, ADENOMAS ☐ NO ☐ YES
9. PREVIOUS GASTRIC RESECTION ☐ NO ☐ YES
10. OTHERS

LOCATION (LEVEL)

☐ Superior 1/3 ☐ Middle 1/3 ☐ Inferior 1/3

LAPAROSCOPIC SURGERY

12. ANAESTHETIC EVALUATION OF THE PATIENT ☐ ASA I ☐ ASA II ☐ ASA III ☐ ASA IV
13. SURGERY DATE
14. EXPLORATIVE LAPAROSCOPY ☐ Before laparoscopy (conventional surgery) ☐ In T4 or M1 tumour (no other interventions ☐ For other reasons
15. Extirpation Surgery ☐ YES ☐ NO
16. TYPE OF RESECTION ☐ Total gastrectomy ☐ Partial gastrectomy ☐ Segment gastrectomy ☐ Other:
17. TYPE OF RECONSTRUCTION ☐ Roux-en-Y ☐ Billroth II ☐ Others:
18. ANASTOMOSIS ☐ All by laparoscopy ☐ All assisted by laparotomy ☐ Only foot of loop laparoscopy ☐ Others:
19. LYMPHATIC RESECTION ☐ D0 ☐ D1 ☐ D2 ☐ D3
20. TYPE OF RESECTION ☐ R0 ☐ R1 ☐ D2 ☐
21. RECONVERSION ☐ YES ☐ NO
22. CAUSE OF RECONVERSION ☐ Haemorrhage ☐ Digestive tract lesion ☐ Technical difficulty ☐ Other
23. PALLIATIVE SURGERY ☐ YES ☐ NO
24. TYPE OF SURGERY ☐ Gastrojejunostomy ☐ Segment gastrectomy ☐ Gastrostomy ☐ Others:
25. DURATION OF INTERVENTION minutes
26. PRE-OPERATORY Hb
27. POST-OPERATORY Hb
28. INTRA-OPERATORY TRANSFUSION concentrates

POST-OPERATORY PERIOD

29. COMPLICATIONS ☐ Haemorrhage ☐ Digestive fistula ☐ Abdominal abscess ☐ Sepsis ☐ Respiratory ☐ Cardiocirculatory ☐ Others:
30. Exitus ☐ YES ☐ NO
31. CAUSE ☐ Haemorrhage ☐ Digestive fistula ☐ Abdominal abscess ☐ Sepsis ☐ Respiratory ☐ Cardiocirculatory ☐ Others:
32. DATE OF SOLID FOOD INTAKE INITIATION
33. TYPE OF ANALGESIA AND DOSAGE
34. DATE OF DISCHARGE
35. DATE OF LAST CONTROL
36. OBSERVATIONS

PATHOLOGICAL ANATOMY

37. HISTOLOGY ☐ Adenocarcinoma ☐ Stromal tumour ☐ Other:
38. LAUREN CLASSIFICATION ☐ Intestinal ☐ Diffuse ☐ Mixed
39. DEGREE OF DIFFERENTIATION ☐ High ☐ Moderate ☐ Low
40. SIZE cm.
41. DISTANCE TO SUPERIOR EDGE cm.
42. DISTANCE TO INFERIOR EDGE cm.
43. T ☐ Tis ☐ 1 ☐ 2 ☐ 3 ☐ 4
44. N ☐ 0 ☐ 1 ☐ 2 ☐ 3
45. M ☐ 0 ☐ 1
46. Stage ☐ Ia ☐ Ib ☐ II ☐ IIIa ☐ IIIb ☐ IV
47. Number of isolated lymph nodes
48. Number of invaded lymph nodes

Figure – Data collection sheet.

gastric adenocarcinoma which are the objective of this analysis (Table 1). Tumour staging was determined using the UICC's TNM classification (5th ed.).[4] Tumours that affected the serous or invaded neighbouring organs were considered to be locally advanced regardless of lymph node affection. The type of lymphadenectomy performed was established based on the criteria of the surgeon carrying out the intervention using the definition established by the Japanese Classification of Gastric Carcinoma.[5] This classification defines the regional lymph nodes in 3 levels depending on the location of the primary tumour, and 4 dissection categories are established (D0-D3). In patients that presented more than one complication, only the one with greater potential seriousness was registered. In spite of the fact that long term follow-up was not included among the initial objectives of this registry, the date of the last control and the patient's state were added.

Results

Clinical pathological characteristics

Of the 245 patients operated on for gastric adenocarcinoma, 154 were men and 91 women. The average age of the series was 69 (12) years old. The dissected tumours were found to be located in a predominant manner in the distal third of the stomach, and the most frequent histological type was intestinal. Thirty-four percent of these tumours presented

infiltration of the serosa, for which they were considered as locally advanced (Table 2).

Types of surgery

Dissection surgery was performed in 232 (95%) cases and derivative surgery in 13 (5%) (Table 3). The most frequent type of dissection was the partial gastrectomy (129 cases), although the total number of total gastrectomies was also elevated (98 cases). Laparoscopic polypectomies and tumourectomies were justified in cases of incipient tumours in very elderly patients with high surgical risks. Both polypectomies were performed by laparoscopic gastrostomy. The tumourectomies were performed using a wedge gastrectomy (Table 3). All of the tumours of the superior third were treated with total gastrectomies, except in one early tumour where a superior polar gastrectomy was performed. The tumours found in the middle third were treated with a total gastrectomy in the majority of the cases, although a partial gastrectomy was performed in 19 cases. A total gastrectomy was preformed in 22 patients with tumours in the inferior third. The reconstruction of the tract in the total gastrectomies was done by means of a Roux-en-Y esophageal-jejunostomy in all of the cases and in 27% of the partial gastrectomies; a Billroth II type gastrojejunostomy was performed (Table 3). The anastomosis were performed completely by laparoscopy in 132 (57%) of the cases, while in 71 (31%) they were assisted by a laparotomy performed for extraction of the portion removed. In all of the cases of assisted gastroenteroanastomosis, the tract was reconstructed by means of a Roux-en-Y gastro-jejunostomy, except in 3 cases where a Billroth II type reconstruction was done. The number of D1 and D2 lymphadenectomies was similar, with a slight predomination of the D2. The average number of lymph nodes extracted and their intervals are shown in Table 3. The average of dissected lymph nodes related to the degree of invasion of the wall of the primary tumour was: 19.6 (13) (1–62) in T1, 20 (13) (1–60) in T2 and 23.11 (12) (2–52) lymph nodes T3. Nine percent of the dissected patients were reconverted to open surgery, with technical difficulties as the most frequent cause. None of the cases where derivative surgery was performed needed reconversion.

Table 1 – Gastric pathologies submitted to the National Registry

Gastric adenocarcinoma	245
Stromal tumours	35
Carcinoid tumours	5
Villous tumour+dysplasia	4
Neuroendocrine cancer	2
Lymphoma	2
Inflammatory tumour (parasites)	2
Inflammatory polyp	2
Adenoscamous carcinoma	1
Plasmacytoma	1
Ectopic pancreas	1
Mesenchymal tumour	1
Glomic tumour	1

Post-operatory complications and morbidity

Thirty-one percent of the resected patients presented post-operatory complications, and in 24% of them, more than one were observed. The most frequent complications were digestive fistulae, followed by cardiorespiratory complications, and intra-abdominal abscesses (Table 4). Fistulae were observed in 14% of the total gastrectomies and in 6% of the

Table 2 – Clinical-pathological characteristics of gastric adenocarcinoma

Number of patients	245	Classification pT (TNM-UICC)	
Males	154	pT	
Females	91	pTis	12
Age, mean (SD), y	69 (12)	pT1	52
ASA		pT2	84
I	8	pT3	73
II	110	pT4	5
III	108	NC	6
IV	15	pN	
NC	4	pN0	112
Resected tumours	232 (95%)	pN1	61
Location		pN2	38
Distal third	130	pN3	15
Middle+distal third	3	NC	6
Middle third	74	Stage	
Middle+superior third	3	0	12
Superior third	22	Ia	40
Type of tumour		Ib	54
Intestinal	141	II	35
Diffuse	70	IIIa	41
Mixed	4	IIIb	24
NC	17	IV	20
		NC	6

Table 3 – Surgery characteristics in gastric adenocarcinomas

Type of surgery	
Resective	232 (95%)
Partial gastrectomy	129
Total gastrectomy	98
Superior pole gastrectomy	1
Polypectomies	2
Tumourectomies	2
Derivative	13 (5%)
Type of reconstruction (partial gastrectomy)	
Billroth II	35
Y loop	94
Type of lymphadenectomy	
D2 117	
D1 105	
D0 6	
NC4	
Number of lymph nodes resected	
D2	26.4 (13) (5–62)
D1	15 (8) (1–43)
D0	5.4 (5) (1–12)
Surgical time, min	
Partial gastrectomy	229 (50)
Total gastrectomy	263 (58)
Reconversion	21 (9%)
Technical difficulty	8
Invasion of neighbouring organs	3
Reconstruction	2
Anastomotic leak	1
Intestinal lesion	1
Others (non-specified)	6
Intake initiation, d	
Without complications	4.7 (2)
With complications	11 (14)
Hospital stay, d	
Without complications	9.2 (3)
With complications	20 (16)

Table 4 – Post-operatory complications and mortality in resective surgery

Post-operatory complications	72 patients (31%)
Cause	
Digestive fistulae	22
Respiratory	8
Intraabdominal abscess	7
Cardiocirculatory	7
Intraabdominal haemorrhage	6
Digestive haemorrhage	3
Abscess of the wall	3
Prolonged ileum	2
Injury infection	2
Urinary infection	2
Stenosis at foot of loop	1
Stenosis mesocolon leaf	1
Intestinal loop perforation	1
Pain (reintervention)	1
Sepsis	1
Infection of venous puncture	1
Haematoma in the injury	1
Thrombocytosis	1
Discompensation of cirrhosis	1
Acute urine retention	1
Intrahospital mortality	14 patients (6%)
Cause	
Sepsis from anastomosic leak	5
Cardiocirculatory	4
Respiratory distress	2
Pulmonary thromboembolism	1
Discompensation of cirrhosis	1
Haemorrhage	1

Table 5 – Participating centres

Hospital of Zumárraga (Guipúzcoa)
Hospital Josep Trueta (Girona)
Hospital of Donostia
Hospital of Igualada
Povisa (Vigo)
Hospital Royo Villanova (Zaragoza)
Hospital Sant Pau (Barcelona)
Hospital La Paz (Madrid)
Hospital Mútua of Terrassa
Hospital Son Llàtzer (Mallorca)
Hospital Sant Joan (Reus)
Hospital del Mar (Barcelona)
Hospital Universitario of Canarias
Hospital Severo Ochoa (Leganés)
Hospital of Serrallana (Torrelavega)
Hospital of Jerez
Hospital Clínico Universitario of Valencia
Hospital Complejo of Jaén

partials. Laparotomy-assisted anastomoses were associated with a higher number of fistulae than those carried out only be laparoscopy when performing the total gastrectomy, while this difference did not exist in the partial gastrectomies. The locally advanced tumours did not present a higher number of fistulae than those where there was no afectation of the serosa. Thirty-eight percent of the patients who underwent a reconversion presented post-operatory complications from the following causes: technical difficulties (3), intestinal lesion (1), leakage after confirming gastrojejunostomy (1), invasion of neighbouring organs (1), and non-specified (2). A blood transfusion was needed during surgery in 23% of patients, with a mode of 2 (interval, 2-10) concentrates of red blood cells.

Intra-hospital mortality of 14 (6%) patients has been observed in the series; among the causes, the infectious complications from digestive leakage and cardiocirculatory complications stand out (Table 4). The anaesthetic risk in these patients was ASA III (8), ASA IV (2), and ASA II (4). The majority of the patients that passed away (8) presented locally advanced tumours.

The time passed until food intake was started and the average hospital stay are shown in Table 3. In spite of the fact that the strict follow-up in time and the state of the patients

were not included in the initial objectives of the registry, an average follow-up of 429 (6-2033) days was observed. The appearance of implants in the orifices of the trocars was never reported in any case.

There are 18 centres that have collaborated in the National Registry (Table 5).

Other registered gastric diseases

Stromal tumours were detected among the remaining cases (35). They were found mostly in the middle and distal thirds; although in 10 cases they were found in the proximal third. The resections performed were segmentary using an endostapler, except for 4 partial gastrectomies and 1 total gastrectomy because of the situation and size of the tumours. The average size was 4.5 (0.6-12) cm, and in 75% of the cases they were >3 cm. Complications were only reported in 4 patients: Respiratory (2), haemorrhage (1), and haematoma from the trocars (1). No cases required reconversion.

Discussion

At the beginning of the decade of the nineties, the first laparoscopic surgery experiences were announced for gastric adenocarcinoma.[6-8] The evolution of minimally invasive surgery in those countries where this disease has a high prevalence has made it evident that the video-assisted distal gastrectomy in early gastric carcinoma presents a series of advantages over open surgery. Among them, less pain, less blood loss, early start for oral intake, and a short hospital stay stand out. Long term follow-up in early tumours, where the type of lymphadenectomy is not as relevant, makes it be considered as safe from an oncologic point of view and well accepted among oriental surgeons.[11] In 2003, more than 1700 patients with gastric cancer were operated on with a laparoscopic-assisted distal gastrectomy in Japan.[12] However, the acceptance in locally advanced tumours continues to be controversial. Short series with locally advanced tumours also show the short term benefits and confirm oncologic safety, although there is still not enough evidence.[13-16] In spite of the existence of trials that discuss the safety of laparoscopic treatment of advanced colorectal tumours regarding their curability, it may seem precipitated to translate these results directly to gastric tumours that affect the serosa, due to the different biological characteristics.[17-19]

An elevated number stands out in the series of total gastrectomies in tumours of the middle third (72%) and in 18% of the localised in the distal third. The lack of tactile feeling may make the identification of the tumour more difficult and influence the decision to establish more extensive resection margins. The size and the macroscopic infiltration of the serosa did not influence in the number of total gastrectomies in the tumours of the middle and distal thirds, which indicates that the decision could be related with the surgeon's preferences for each case.

Currently, a controversy persists about the benefits of the extension of the lymphadenectomy in the radical treatment of the disease. The Japanese experience shows the benefits of the D2 lymphadenectomies in the long term follow-up of locally advanced tumours. However, the randomised prospective studies carried out in the West have not been able to confirm these results.[20,21] Independent of the debate created, the extensive lymphadenectomies decrease loco-regional relapses.[22] Although a D2 lymphadenectomy was carried out in 50% of the resected patients, the fact that in 46% of the locally advanced tumours a D1 or lower lymphadenectomy was performed is surprising. In spite of the fact that the average number of lymph nodes extracted related with the type of lymphadenectomy seems reasonable, the inferior ranges in the lymphadenectomies and the differences between the participating centres are surprising. If we analyse T3 tumours, an average of 23.1 (12) lymph nodes resected can be observed, but, while in one of the centres it was 28 (14), in another centre with a similar number of cases, the average of lymph nodes resected was 9.1 (5).

The reconversion rate is low (9%) when compared to other studies that report between 1.1% and 33%.[11,23,24] Technical difficulties (53%) stand out among the causes. In the majority of the cases the type of difficulties was not included, although they were more frequent in locally advanced tumours. In spite of the fact that intra-operatory haemorrhages are a frequent cause of reconversion in the majority of previously published studies, it has been impossible to relate them with the technical difficulties of our series.

When analysing the rate of post-operatory complications (32%), the fact that the most frequent and less frequent have been included must be kept in mind, and that it is dealing with a registry without predefined inclusion criteria, that includes the initial experience of the majority of the surgeons, with a large number of high risk patients (ASA III-IV), with a high percentage of advanced stages and in those where extensive lymphadenectomies have been performed. The literature review shows rates that may oscillate between 11.8% and 35%.[17,25] However, even open surgery with D2 lymphadenectomies have been associated with complication rates that have reached 43% to 46%.[20,21] In the series, digestive fistulae occurred with greater frequency in total gastrectomies. Those assisted by laparotomy were associated in a significant manner with a greater number of fistulae than those performed only by laparoscopy. The patients that required reconversion presented a post-operatory complication rate slightly superior than that observed in the total of the series, which indicated that this subgroup of patients requires strict surveillance. The analysis of the temporary appearance of complications showed that they started to decrease as the centres accumulated more experience. With the objective to improve the results, it seems recommendable to be familiarised with the standard procedures in open surgery of gastric cancer, as well as counting on the guidance of surgeons with previous experience in the first cases. Among the causes of mortality, the cardiorespiratory complications and sepsis secondary to anastomotic leaks stand out, which make the reconstruction of the tract one of the most relevant technical aspects.

To date, there are 2 meta-analysis about laparoscopic distal gastrectomies compared with those performed with open surgery.[26,27] Four controlled and randomised trials and

12 retrospective studies were included in one of them, and it was concluded that the laparoscopic distal gastrectomy was associated with a lower morbidity, less pain, early transit, and short hospital stay, but with a lower number of lymph nodes resected. However, another posterior meta-analysis that exclusively included the same 4 controlled and randomised trials has only demonstrated lower blood loss at the expense of a greater surgical time and lower number of lymph nodes extracted. In spite of the existing limitations in the interpretation of the data (few trials, limited number of cases, and short follow-up period), the authors concluded that their systematic applications could not be recommended.[26]

To conclude, laparoscopic surgery in gastric cancer is a technically complex procedure that is initially associated with a large number of complications. The consolidation of said procedure in clinical use will depend on if it can be carried out with low morbidity and the confirmation of long term oncologic safety. The registries, in which certain conditions to homogenise criteria have not been previously established, may present biases and limitations for its precise analysis. However, it enables us to understand what is being done in the day-to-day in our hospitals.

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