

# EFFECTS OF TOTAL GASTRECTOMY (TG) EXTENSION ON POSTSURGICAL COMPLICATIONS

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**Keywords:** gastric cancer, surgical complications, mortality

**Abstract:** The authors have operated a number of 416 patients with gastric cancer, between 1988 and 2001. Among them, 305 patients were resectable. The resection rate was of 73,3%. Total Gastrectomy (TG) was performed in 161 patients (52,8% of resections). TG with omentectomy was performed in 44 patients. 96 patients underwent splenectomy, 19 patients underwent splenectomy with resection of the left side of the pancreas and in 8 patients, other organs' resection was performed with the standard TG; two field lymphadenectomy has been performed only in the past few years. Uneventful recovery followed in 100 cases, (62%), 61 patients, (38%) suffered complications in the postoperative period. The most frequent surgical complications were anastomotic leak, which was observed in 8 patients (5%). Septic complications, intraluminal bleeding postoperative pancreatitis, intra abdominal bleeding, pancreatic fistula and small bowel obstruction were the most frequent surgical complications. Most general complications occurred in the cardiorespiratory system. In 9 patients, re-operation was necessary. Eight patients (5%) died in the postoperative period. In the patients with extended gastrectomy, significant more complications occurred compared with gastrectomy plus omentectomy. This could also be observed in the patients with splenectomy only. If more organs were removed or resected with T G. and splenectomy, the complications rate increased only if pancreatic resection was performed. Mortality rate increased in these patients as well. The esophageal or other neighbouring organs (colon, intestine, liver etc) resection had no influence on the postoperative morbidity and mortality. Extended operations should be performed as the risk is acceptable, if there is hope for tumour clearance.

**Cuvinte cheie:** neoplasm gastric, complicații postoperatorii, mortalitate

**Rezumat:** Autorii au operat în intervalul 1988-2001, 416 bolnavi cu neoplasm gastric. Rezecția a fost practică la 305 bolnavi. Rata de rezecabilitate a fost de 73,3%. G.T. s-a efectuat la 161 de bolnavi ceea ce a reprezentat 52,8% din rezecții. Cu ocazia G.T. la 44 de bolnavi a fost îndepărtat doar marele epiploon împreună cu stomacul, iar în 118 cazuri a fost extinsă intervenția. S-a practicat la 96 de cazuri splenectomie, a fost asociată spleno-pancreatectomie stângă la 19 cazuri, segmentul toracic al esofagului a fost rezecat la 8 cazuri, iar la 8 cazuri s-a ajuns la rezecția altor organe. Limfadenectomie largită, peste D<sub>1</sub>, a fost efectuată numai în ultimii ani. Evoluția postoperatorie a fost fără incidente în 100 (62 %) cazuri, iar la 61 (38%) de bolnavi au apărut complicații. Complicația chirurgicală cea mai frecventă a fost insuficiența anastomotică în 8 (5%) cazuri. În ordinea frecvenței a urmat supurația plăgii, abcesul abdominal, hemoragia intraluminală, pancreatita postoperatorie, hemoragia peritoneală, fistula pancreatică și ocluzia mecanică. Cele mai multe complicații generale au fost cardio-respiratorii. S-au reoperat 9 cazuri. Decesele intraspitalicești au reprezentat 5% (8 cazuri). Comparând cu grupul doar ometectomizat, lărgirea intervenției la organele vecine a determinat creșterea semnificativă a complicațiilor totale și chirurgicale. Acest fenomen s-a produs și după splenectomie, acolo unde în afara splenectomiei au fost rezecate și alte organe, numai rezecția pancreatică a dus la creșterea în continuare a complicațiilor. Incidența mortalității a fost mai semnificativă doar după pancreatectomie. Rezecția esofagiană și a altor viscere (colon, intestin, ficat, diaphragm, etc.) nu a influențat în mod semnificativ morbiditatea și mortalitatea post operatorie. Se pare că din rațiuni de principiu este indicată doar extensia la limfaticile regionale ale rezecției. Dacă extensia tumorii cere, intervențiile largite se pot efectua cu risc acceptabil.

## INTRODUCTION

Invasive gastric tumours can be removed by resection of the proximal, distal, subtotal or total gastrectomy depending on their topography. In advanced cases of proximal tumour, resection of proximal cancer does not meet the oncologic requirements, therefore, today most surgeons have abandoned it preferring the TG technique. Increased incidence of gastric tumours in the mean and upper 1/3, as well as the increased

number of undifferentiated tumours brought about the TG percentage increase. Thus, today 40-80% of resections are total.

Due to the possible spread of the tumour, resection should be extended to lymphatic channels and commonly in neighbouring viscera.

## PURPOSE OF THE STUDY

We tried to identify the major sources of

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complications in the patients operated for gastric cancer and the possibilities of intervention for their elimination and mortality reduction.

### MATERIAL AND METHODS

The study is based on the retrospective analysis of a number of 416 cases of gastric cancer operated within the Emergency Clinical County Hospital of Sibiu during 1988 and 2001. Resections were performed in 305 patients, resection percentage being of 73.3 in the studied batch. In 161 cases, GT has been practiced, corresponding to 52.8% of resections. Sex ratio (male / female) was 2/1, the average age per batch being 62 years old. Approximately, two thirds of the patients had associated diseases: cardiovascular diseases recorded 101 cases (24.2%), pulmonary - 31 cases (7.2%), diabetes mellitus type II - 11 cases (2.6%) and other malignant diseases - 9 cases (2.1%) represented by tumours in anamnesis or synchronous tumours. Tumour type, tumour localisation in the stomach and distribution stages are presented in Table 1.

**Table no. 1. Clinical and histological features of tumours in the study group**

Tumour localisation at stomach level	No. of cases
1/3 proximal	68
1/3 medial	55
1/3 distal	17
Entire stomach of gastric stump	15
Total ^	6
Total ^	161
Histological types	
Adenocarcinoma	148
Malign lymphoma	10
Sarcoma	2
Metastasis	1
Total ^	161
Stage of carcinoma	
IA	1
IB	1
II	13
IIIA	42
IIIB	65
IV	26
Total ^	148

The compliance with the tumour stage (urcc 1992) was performed after the histological outcome of the surgical piece. 2/3 of the tumours was in stage III-IV and was located in 1/3 medial on average and 1/3 proximal to the stomach. Most interventions were performed for adenocarcinoma. A patient, PT 60 years observation sheet: 10793/1993 was operated for small cell lung tumour known for life-threatening haemorrhage. Intraoperatively, it was established that the tumour occupying much of the stomach was actually a giant lung tumour metastasis. Each patient received thrombosis prophylaxis, while systemic antibiotic prophylaxis was not applied. Most interventions were performed in medial laparotomy (table no. 2).

In some cases where the tumour has infiltrated the cardia, the thorax was opened through left, right or transhiatal median approach. 128 intra-abdominal anastomoses were performed and 33 intrathoracic anastomoses. Anastomoses were performed manually by plugging in two layers and mechanically in some cases. Upon each TG, the great and lesser omentum were removed. The intervention extension comprised the great omentum, and in total 336 neighbouring organs (Table 3). In 5 cases, splenectomy was necessary by accidental injury.

Intervention grouping taking into account the direction of extension is presented in table no.4.

TG with omentectomy has been practiced in 44 cases. During TG, the great and lesser omentum with the spleen were the organs most commonly removed, followed by esophagus, and left spleno-pancreatectomy. In some cases, it was necessary to remove other organs, as well.

**Table no. 2. Surgical approach, method of anastomosis and anastomosis position**

Surgical approach	No cases
Median laparotomy	125
SupraUmbilical	3
Transversal	7
Proximal medial	21
Thoraco-frenolaparotomy left	
Proximal median laparotomy	2
plus right thoracotomy	3
Median laparotomy plus left thoracotomy	
Median laparotomy plus	
Transdiafragmatic approach Pinotti	
Total	161
The method of anastomosis	
Clogging telescope esophagus	77
Double layer with 18 separate threads	18
Mechanical EEA, ILS	
Total	161

**Table no. 3. Resection of the neighbouring organs upon TG**

Body resected	No. of cases
Great and lesser omentum	161
Spleen	115
Segment of the distal thoracic esophagus	33
Caudal pancreas or caudo-corporeal to the left of superior mezentheric vein	19
Transversal colon	3
Left liver lobe	2
Diaphragm muscles	2
Small intestine	1
Total	336

**Table no. 4. Direction of TG intervention extension**

Extension	No. surgery cases
Only the great and less omentum	44
Spleen	66
Spleen and lower thoracic esophagus	24
Spleen + hemidiafragm organs+ left part	2
Transversal colon	1
Ileon	1
Esophagus, liver, pillar diaphragm	1
Esophagus, transversal colon	1
Pancreas + spleen	12
Pancreas + spleen + Esophagus	7
Liver, diaphragm	1
Transvers colon	1
Esopha	2
Total	161

Based on the assessment of surgery time, of the histological results, we managed to achieve the R<sub>0</sub> status in 123 cases, R<sub>1</sub> in 14 cases and R<sub>2</sub> in 24 cases. We should mention that the status of those 123 R<sub>0</sub> does not have an adequately histological support as enlarged D<sub>2</sub> limphadenectomy was performed only in the last years and only by two surgeons. For the second part of the study, D<sub>2</sub> (1992-1997), limphadenectomy period corresponds and limphadenectomy technique is not yet uniform even today. For this reason, we cannot afford to consider the radical effects of limphadenectomy on the evolution and stage of the disease and complications. To identify significant interferences, Bonferroni correction was

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used, starting from the idea that in the presence of conducting "n" statistical tests, the unused "p" was of 0.05 / n. In some cases, the  $\chi^2$  test has been replaced by the exact Fisher test in the case of the groups compared with fewer patients groups.

### RESULTS

Postoperative course was without incidents in 100 cases (62%), in 61 cases (38%) complications occurred, which are shown in Table 5. In consideration of surgical complications, the basic complication was recorded in each case. It is obvious that all anastomotic fistulae abscess is small or large, but these cases were recorded only as anastomotic fistula. The occurrence of general complications due to severe surgical complications was not regarded as a separate event. This principle was applied to determine the causes of mortality.

**Table no. 5. Postsurgical complications, re-interventions and mortality after GT**

Surgical complications	No. cases (%)
Anastomotic fistula	8 (12,5%), (2R), (1)+
Intraperitoneal absces	4 (6,2%), (1) R
Wound suppurat	6 (3,7%)
Intraluminal bleeding three	3 (1,8%), (2) R
Abdominal hemorrhage	2 (1,2%)
Pancreatitis	3 (1,8%), (2)R, (2)+
Pancreatic fistula	2 (1,2%)
Occlusion	2 (1,2%), (2)R
General complications	No. cases (%)
Heart Failure	7 (4,3%)
Pneumonia	13 (8%), (3)+
Other pleuropulmonary compl.	2 (1,2%)
Trombophlebitis	2 (1,2%), (1)+
Stroke	2 (1,2%), (1)+
Iatrogenic urinary infections	6 (3,7%)
Hepatic failure	1 (0,6%)

Legend: R= reintervention, += death

The most common surgical complication was the anastomotic fistula in 8 cases (5%). Within these, 1 case of 77 (1.3%) occurred after the plugging technique, 6 of 66 cases (9.1%) occurred after the double-layer suture with separate threads and 1 of 16 (5.5%) after mechanical circular anastomosis. In order of frequency, wound discharge, abdominal abscess, intraluminal bleeding and postoperative pancreatitis followed. In other 2 cases, we observed hemoperitoneum, pancreatic fistula and intestinal obstruction. 2 patients were reoperated due to anastomotic fistula, 2 patients for bleeding and one for left abscess subfrenic. Other 2 interventions were

required for severe pancreatitis and obstruction. Most comorbid conditions were the cardio-respiratory. In the hospital postoperative period, 8 (5%) of patients died. Deaths were caused by pneumonia in 3 cases, of pancreatitis in 2 cases, both reoperated after reintervention for anastomotic fistula; one patient died and 2 patients died of stroke and embolism. In table 6, we presented the modalities according to which the intervention extension influenced the number of complications and mortality. By analyzing the table 6, one can observe the intervention extension on the nearby organs (group 8). The total number of complicated cases ( $p1 < 0.05$ ) increased significantly compared with group 1 where only omentectomy was performed. This occurred as a consequence of splenectomy (group 2),  $p1 < 0.05$ . In the cases, where besides splenectomy, other viscera were interested, only pancreatic resection (group I) increased the number of complications. In this group, the total number of complications was significant higher ( $p2 < 0.05$ ), but this could not be separately demonstrated in surgical complications, or in the general complications. Mortality was also higher as ( $p2 < 0.05$ ), as against the group that included only splenectomy. Intervention extension has not demonstrably influenced mortality. Of 44 patients with TG and omentectomy, 2 died (4.54%), and after 117 enlarged interventions, 6 (5,12) died, which based on the Fisher test, there is a  $p > 1.0$ , so far from being statistically significant. I could not make other comparisons statistically acceptable and scientifically permissible, due to the small number of the studied groups.

### DISCUSSIONS

In the Western world, gastric cancer prognosis is still grim despite all efforts made. Global survival at five years, for all the treated cases is reported between 20-45% for Europe between 1984-1999, and since 1990, it has increased to 67% in  $R_0 D_1$  resections, at 35% in  $R_0 D_2$  resections and at 12% in  $D_3$  resections.(1) Chemotherapy failed to improve these results.(2,3,33) Success in Japan is based on early recognition and on the interventions with a standardized extremely accurate technique. In Japan, the survival rate at 5 years raised up to 90% in  $N_0$  cases, and to 75-89% in  $N1$  cancer metastasis.(4) Gastric cancer, although decreased in incidence over the past two decades, especially the intestinal type, remains a disorder with late detection in many countries, including Romania.(34,35,36)

In our work we analyzed mortality and postoperative complications in the patients with TG. Patient sex, age, comorbidity, tumour stage may influence the postoperative evolution, but in the present paper aimed at analysing only the effects of extended TG.

**Table no. 6. Comparison of the evolution of complications and mortality in the intervention groups based on the intervention extension**

Group	Extension	No. Op.	Complicated cases			Type of complication						Mortality		
			No. cases	p1	p2	Chirurgical			General			N	P1	P2
1	Small and great omentum	44	9			N	P1	P2	N	P1	P2	N	P1	P2
2	Spleen	66	28	< 0,05		15	<		17	Ns		2	Ns	
3	Spleen + omentum	24	10	<0,05	Ns	6	<	Ns	5	Ns	Ns	1	Ns	Ns
4	Spleen + other viscera	6	1	Ns	Ns	1	Ns	Ns	0	Ns	Ns	0	Ns	Ns
5	Spleen + pancreas	12	9	<0,05	<0,05	4	<	Ns	5	<	Ns	2	Ns	<
6	Spleen + pancreas+ other viscera	7	4	<0,05	Ns	1	Ns	Ns	3	Ns	Ns	1	Ns	Ns
7	Esophagus	2	0	Ns		0	Ns		0	Ns		0	Ns	
8	Group 2 – 7 total	11	52	<0,05		27	<		30	Ns		6	Ns	

Legend: P1 = p values of group 1 compared with groups 2 – 8; P2 = p values of group 2 compared with groups 2 – 5; NS = insignificant

Above all, we must define what we mean by extended intervention. In our view, we talk about extended intervention when for the complete extirpation of regional adenopathies, we remove organs that are not invaded by tumours or parts thereof and the surrounding lymph nodes. The first organ whose removal routine was introduced was the great omentum. This was followed by splenectomy and caudal splenopancreatectomy within the TG and the upper polar. In those cases, where the partial or total removal of viscera is due to the tumour invasion, the intervention is defined as a combined intervention.(5,6) The English and German literature uses the term "extended gastrectomy" (Extended Gastrectomy, erweiterte Gastrectomie). In terms of potential complications, it is the same whether the sacrifice of the neighbouring viscera is done by reason or by necessity, therefore we will not make any difference and will talk only about extension. In the light of those presented, each TG performed for tumour can be regarded as an extended intervention as the great and lesser omentum was systematically removed. By analysing the complications, the group of patients with TG and omentectomy was regarded as the basis, whereas the great omentum may have a role in localizing the abdominal inflammatory processes and its absence does not affect the body. With the removal of the great omentum, the number of the removed ganglions does not increase. It is true that in the assessed tumours, we often reveal direct tumour infiltration or carcinomatosis, but in such cases, omentectomy will improve significantly the TG radicality. In our practice, the next extension also refers to splenectomy with the exception of two cases, where only one the third of the lower esophagus was removed. Beyond omentectomy, splenectomy associated with the TG was performed in 66 patients. This is the largest surgical group, which is not accidental. In the years 1950-1960, there was an opinion according to which, TG is systematically accompanied by caudal pancreatectomy and splenectomy with a view to radical limfadenectomy. In the early '80s, after the favourable Japanese experience, extended lymphadenectomy began to be conducted in Europe.(7,8).

In the German prospective study, in 787 TG, there were 492 splenectomies. Based on the analysis of this group, it was found that splenectomy did not influence any postoperative morbidity or mortality evolution, but the incidence was higher in intra-abdominal abscesses.(9) In England, by analyzing the M.R.C. Gastric Cancer Surgical Trial data, it was proved that in case of extended TG with splenectomy, morbidity jumped from 28% to 54% and mortality from 4% to 16%.(10) In the Italian study, randomized splenectomy increased morbidity from 13% to 21%. In cases where the resection was extended to other viscera, the number of complicated cases rose to 31%.(1) In the Dutch prospective randomized study on gastric cancer, in 711 interventions, 492 splenectomies were performed and in 108 cases left splenopancreatectomies were accomplished.

After a multivariate analysis, splenectomy mostly influenced morbidity and from the clinical mortality point of view, it was the third most important risk factor.(12) From our material, it shows that splenectomy significantly increased the complicated cases and surgical complications. This could not have been found in the general complications, too. Multiple retrospective studies based on heterogeneous material showed that splenectomy negatively influenced the results at distance (13,14,15,16,31,32). The first prospective randomized study that demonstrated the prognostic effect of splenectomy was the Italian one, which has already been mentioned.(17) In recent years, the indication of splenectomy has become more selective.(14,15,18,19,16,25,26,27) Schmid found the indication for splenectomy in proximal gastric tumours only in cases of tumour invasion of the spleen or when there are proven

metastases in the spleen hilum.(19) Left pancreatic resection provides a better approach and facilitates complete lymphadenectomy, the publications of the European centres showing a favourable experience in this intervention.(20,21) On the other hand, many authors emphasize that the possible postoperative complications make pancreatic resection the most critical intervention for the extended gastric cancer.(28,29,30) In Japan, these types of mortality after resection is of 5-10% (22,24) The material published by Kitamura, surgical mortality did not reach 6% but no positive effect has been demonstrated in the case of invaded lymph nodes located along the splenic artery. If the tumour infiltrated the pancreas directly, the results were better.(22) After these interventions, we should primarily expect abdominal abscess and fistula occurrence.(10,12) According to Cuschieri, subclinical extravasation of the pancreatic juice may jeopardize anastomotic healing.(10) In fact, it has been noted in Japan as well, that pancreas preservation reduces the incidence of postoperative complications. Already, in 1987, Maru Yama underlined the benefits of extended lymphadenectomy with the preservation of pancreas.(24) After our knowledge, its application, of the extended lymphadenectomy in our country, it has not yet become systematic. In our experience, pancreatic resection was performed only in cases of direct invasion of the gland and even in these conditions, the pancreas is after the omental and the spleen, the third most commonly affected organ. In 3 cases of pancreatic resection, our pathologists failed to demonstrate the infiltration of the operated pancreas. In these cases, the misleading adhesions were determined by the peritumoral inflammation, probably by tumoural limphangitis or by a history of pancreatitis. In cases with problems, it is possible to decide to separate the stomach from the pancreas, after which, the extemporaneous intraoperative examination may avoid the undue expansion of the intervention, attitude that was not presented in our material. On the occasion of nodal dissection along the hepatic and splenic artery, we should be careful at pancreas integrity. Due to the already mentioned cases, we cannot analyze the complications of limphadenectomy; we just mention that in both cases, deceased by necrotizing acute pancreatitis, enlarged D2 lymphadenectomy was performed. Pancreatic resection increased postoperative morbidity in relation to those in which splenectomy has been performed and general complications were significantly more frequent. In this group, mortality was higher, 2 from 12 patients dying (11%). TG extension beyond pancreatic resection was performed in 7 patients. Due to the small number of cases, no conclusions can be drawn, but the number of complications did not increase significantly, although we also lost a patient in this group as well. Extended intervention beyond the spleen to esophagus and other viscera (liver, colon etc.) was not followed by an increase in the percentage of complications that we observed after pancreatic resection. This aspect should be taken into consideration in the case of intervention extension on the esophagus, as in these interventions, both cavities needed to be opened: chest and abdomen. Based on literature and our experience, we may say that the TG extension increases mortality and the incidence of postoperative complications. Most critically, we should refer to splenectomy and pancreatic resection. Routinely, pancreatic resection and splenectomy is not considered a tactic to follow. Resection of other viscera is not followed by so important risks and it becomes necessary in case of direct tumour invasion. Currently, it seems that in principle, the intervention should be extended only to nodal stations. In the resection of other organ, the decision should be taken according to the potential risks and expected results. At the same time, it cannot be forgotten that in these patients in advanced stages, the

sometimes large palliative resection is the only chance and so, by accepting higher risks, it can provide extended life and improved quality of life, which was emphasized two decades ago, by Professor VE Bancu.

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