



# Distal Gastrectomy vs. Total Gastrectomy for Surgical Management of Distal Gastric Cancer: A Comparative Study

Ahmed K El-Taher<sup>1</sup>, Ramadan Mahmoud<sup>1</sup>, Ehab M Oraby<sup>2</sup>, Elsayed I El Hendawy<sup>1</sup>, Basant Sh El Shafaey<sup>3</sup>, Amr Samir<sup>4</sup>, Ahmed M Elsayed<sup>5</sup>, Ola A Harb<sup>6\*</sup>

<sup>1</sup>Department of General Surgery, Zagazig University, Egypt

<sup>2</sup>Department of General Surgery, Benha University, Egypt

<sup>3</sup>Department of Clinical Oncology and Nuclear Medicine, Zagazig University, Egypt

<sup>4</sup>Department of Internal Medicine, Zagazig University, Egypt

<sup>5</sup>Department of Tropical Medicine, Zagazig University, Egypt

<sup>6</sup>Department of Pathology, Zagazig University, Egypt

## Abstract

**Background:** There is no sure criteria of selection the best technique of managing distal gastric cancer that provide a sufficient length of free proximal margin, moreover, there are no sufficient prospective studies that compare the survival rates of patients who underwent both techniques of management.

Therefore, the current study aimed to compare between total gastrectomy and distal gastrectomy in management of distal gastric carcinoma regarding the operative, post-operative parameters and effect on patients' survival.

**Materials and Methods:** We enrolled a total of 30 patients with operable distal gastric cancer who were divided into two separate groups the first group which included 15 patients underwent total gastrectomy and the remaining 15 patients in the second group underwent distal gastrectomy. We recorded operative and post-operative data in addition to survival rates of the patients and compared between the two studied groups.

**Results:** we showed that the total gastrectomy has a longer duration of the operation, a larger amount of intra-operative blood loss ( $p < 0.001$ ), longer duration before starting diet ( $P = 0.008$ ), and longer duration of staying at hospital after the operation ( $P = 0.005$ ) than the distal gastrectomy group. Patients who underwent distal gastrectomy has a lower incidence of cancer recurrence ( $p = 0.002$ ), lower incidence of mortality ( $p = 0.005$ ), favorable recurrence free ( $p = 0.009$ ) and overall survival rates ( $p = 0.003$ ), than patients who underwent total gastrectomy.

**Conclusion:** Distal gastrectomy is a feasible and safer surgical procedure than total gastrectomy for management of distal gastric cancer as regard; operative, post-operative, long term patients' nutritional status, outcome and survival.

**Keywords:** Total gastrectomy; Distal gastrectomy; Distal gastric cancer

## Introduction

Carcinoma of the stomach is an aggressive cancer that has been considered the 2<sup>nd</sup> cause of cancer related mortality and morbidity [1]. Surgery remains the main approach of its management with different management modalities according to its location within the stomach as; proximal gastrectomy, distal gastrectomy or total gastrectomy in addition to extended lymphadenectomy [2]. The 1<sup>st</sup> case of cancer stomach with successful performance of total gastrectomy has been made since hundreds of years, and since then there is a controversy regarding the best surgical approach of management of distal gastric cancer [3]. The limits of gastric resection for treatment of gastric cancer are determined by the size and stage of the tumor, in addition to its location within the stomach and the distance of proximal edge resection [4]. Total gastrectomy could remove a major amount of cancer and could markedly decrease malignant remnants, but it has been many recorded drawbacks

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### \*Correspondence:

Ola A Harb, Department of Pathology,  
Zagazig University, Egypt,  
E-mail: olaharb2015@gmail.com

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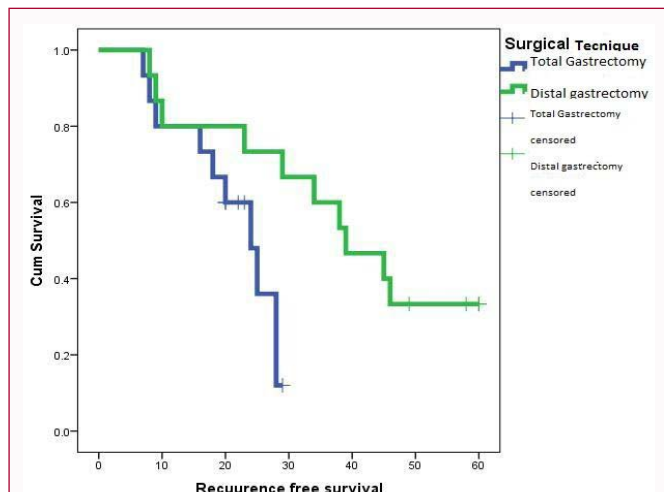
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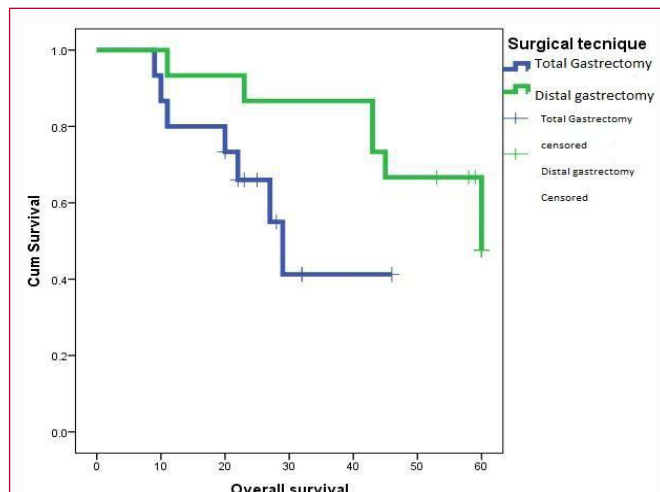
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**Figure 1:** Kaplan Meier plot showing recurrence free survival (time to recurrence) among patients underwent different surgical techniques (Mean RFS in total gastrectomy was 21.28 while mean RFS in distal gastrectomy was 37.12 with a statistically significant difference between them,  $p < 0.05$ ).



**Figure 2:** Kaplan Meier plot showing overall survival (time to death) among patients underwent different surgical techniques (Mean RFS in total gastrectomy was 30.88 while mean RFS in distal gastrectomy was 51 with a statistically significant difference between them,  $p < 0.05$ ).

as; postoperative dysphagia, limited oral intake, marked dryness of the mouth and symptoms of reflux that lead to poor quality of life of the patients [5]. Choosing the surgical approach of management of distal gastric cancer is dependent on surgeons' opinion and experience which differs among different regions [2]. So, there is no sure criteria of selection the best technique of managing distal gastric cancer that provide a sufficient length of free proximal margin, moreover, there are no sufficient prospective studies that compare the survival rates of patients who underwent both techniques of management.

Therefore, the current study aimed to compare between total gastrectomy and distal gastrectomy in management of distal gastric cancer regarding the operative, post-operative parameters and effect on patients' survival.

## Materials and Methods

From March 2014 to August 2019, we enrolled a total of 30 patients with operable distal gastric cancer who were divided into two separate groups the first group which included 15 patients underwent total gastrectomy and the remaining 15 patients in the second group underwent distal gastrectomy. All case were operated in General Surgery Department Zagazig University Hospital, all included cases in the study were prospectively enrolled and followed up for five years in our study.

The primary diagnosis of gastric cancer was confirmed by endoscopic gastric biopsy. Full radiological evaluation of patients for accurate clinical staging was done with gastric ultrasound examination, computed tomography scans of the abdomen and pelvis, in addition to full upper gastrointestinal laparoscopic exploration.

### The inclusion criteria of patients were as follows

1. Patients with a histologically confirmed adenocarcinoma of the stomach located in the lower third.
2. Patients haven't received any pre-operative neo-adjuvant chemotherapy.
3. Operable patients that were clinically and radiologically without distal metastasis.
4. Patients who underwent radical gastrectomy.

5. Patients with negative proximal surgical margin.
6. Patients with complete post-operative follow-up records.

### The inclusion criteria of patients were as follows

1. Patients with other histopathological sub-types of gastric cancer as gastric lymphoma and gastrointestinal stromal tumors.
2. In operable patients.

We have acquired an approval from the local Ethics Committee of Faculty of Medicine Zagazig University for that study and obtained a written informed consent pre-operatively from all included patients.

All of the included patients underwent total gastrectomy or total gastrectomy according to Japanese Gastric Cancer management guidelines recommendations [6]. All included patients were subjected to full upper gastro-intestinal laparoscopic evaluation to exclude occurrence of distant metastases.

### Surgical treatments

We made laparoscopic exploration to all patients to exclude distant metastases.

The principles of performing total or distal gastrectomy were based on the guidelines of Japanese gastric cancer treatment [6,7]. Distal gastrectomy would be the preferred surgical approach if we could obtain a negative proximal safety margin.

The applied rules of the resection safety margin during the operation were as follows:

The proximal resection safety margin was at least three cm in tumors which invaded the muscle layer of the stomach, tumors having an expansive pattern of growth, or about 5 cm for those tumors that have an infiltrative pattern of growth. In case of tumors that were just invading the mucosa or submucosa, we must obtain a resection margin of at least 2 cm.

Before we discharged the patient from the hospital, we must detect the following criteria: absence of and subjective complaints, ability to tolerate solid oral intake, returning of function of the bowel, absence of parenteral medications, proper daily life mobility and self-

**Table 1:** Correlations between total gastrectomy and distal gastrectomy for treatment of distal gastric cancer regarding demographic and pathological parameters.

| Variables                             | Total           | Surgical Techniques |                    | p     |
|---------------------------------------|-----------------|---------------------|--------------------|-------|
|                                       |                 | Total gastrectomy   | Distal gastrectomy |       |
| <b>Age groups</b>                     | <b>N=30 (%)</b> | <b>N=15 (%)</b>     | <b>N=15 (%)</b>    |       |
| <60 years old                         | 10 (33.3)       | 6 (60)              | 4 (40)             | 0.439 |
| >60 years old                         | 20 (66.7)       | 9 (45)              | 11 (55)            |       |
| <b>Gender</b>                         |                 |                     |                    |       |
| Male                                  | 22 (73.3)       | 11 (50)             | 11 (50)            | 1     |
| Female                                | 8 (26.7)        | 4 (50)              | 4 (50)             |       |
| <b>Comorbid condition</b>             |                 |                     |                    |       |
| Absent                                | 15 (50)         | 10 (66.7)           | 5 (33.3)           | 0.068 |
| Present                               | 15 (50)         | 5 (33.3)            | 10 (66.7)          |       |
| <b>Size of mass (cm):</b>             |                 |                     |                    |       |
| <5 cm                                 | 9 (30)          | 5 (55.6)            | 4 (44.4)           | 0.311 |
| ≥ 5 cm to 10 cm                       | 21 (70)         | 10 (47.6)           | 11 (52.4)          |       |
| <b>Histopathological type</b>         |                 |                     |                    |       |
| Intestinal                            | 21 (70)         | 12 (57.1)           | 9 (42.9)           | 0.232 |
| Diffuse                               | 9 (30)          | 3 (33.3)            | 6 (66.7)           |       |
| <b>Grade</b>                          |                 |                     |                    |       |
| Poor                                  | 11 (36.7)       | 4 (36.4)            | 7 (63.6)           | 0.47  |
| Moderate                              | 13 (43.3)       | 8 (61.5)            | 5 (38.5)           |       |
| Well                                  | 6 (20)          | 3 (50)              | 3 (50)             |       |
| <b>T stage</b>                        |                 |                     |                    |       |
| T1a                                   | 7 (23.3)        | 3 (42.9)            | 4 (57.1)           | 0.991 |
| T2                                    | 4 (13.4)        | 2 (50)              | 2 (50)             |       |
| T3                                    | 6 (20)          | 3 (50)              | 3 (50)             |       |
| T4a                                   | 7 (23.3)        | 4 (57.1)            | 3 (42.9)           |       |
| T4b                                   | 6 (20)          | 3 (50)              | 3 (50)             |       |
| <b>N stage</b>                        |                 |                     |                    |       |
| N0                                    | 10 (33.3)       | 5 (50)              | 5 (50)             | 0.958 |
| N1                                    | 6 (20)          | 3 (50)              | 3 (50)             |       |
| N2                                    | 5 (16.7)        | 2 (40)              | 3 (60)             |       |
| N3                                    | 9 (30)          | 5 (55.6)            | 4 (44.4)           |       |
| <b>Stage</b>                          |                 |                     |                    |       |
| IA                                    | 4 (13.3)        | 2 (50)              | 2 (50)             | 0.795 |
| IB                                    | 4 (13.3)        | 1 (25)              | 3 (75)             |       |
| IIA                                   | 4 (13.3)        | 3(75)               | 1 (25)             |       |
| IIB                                   | 6 (20)          | 3 (50)              | 3 (50)             |       |
| IIIA                                  | 1 (3.3)         | 0 (0)               | 1 (100)            |       |
| IIIB                                  | 2 (6.7)         | 1 (50)              | 1 (50)             |       |
| IIIC                                  | 9 (30)          | 5 (55.6)            | 4 (44.4)           |       |
| <b>Number of retrieved lymph node</b> |                 |                     |                    |       |
| 14-Jan                                | 9 (30)          | 1 (15)              | 8 (85)             | 0.007 |
| 15–25                                 | 9 (30)          | 5 (55)              | 4 (45)             |       |
| >25                                   | 12 (40)         | 9 (75)              | 3 (25)             |       |
| <b>Margin status:</b>                 |                 |                     |                    |       |
| Free                                  | 16 (86.7)       | 13 (50)             | 13 (50)            | 1     |
| Invaded                               | 4 (13.3)        | 2 (50)              | 2 (50)             |       |

|                                  |                |                |         |                |          |
|----------------------------------|----------------|----------------|---------|----------------|----------|
| <b>Operation time:</b>           |                |                |         |                |          |
| Mean ± SD                        | 198.33 ± 52.68 | 237.07 ± 26.47 | 200-300 | 159.6 ± 42.81  | <0.001** |
| Range                            | 20-300         | 200-300        |         | 20-200         |          |
| <b>Estimated blood loss (ml)</b> |                |                |         |                |          |
| Mean ± SD                        | 193.83 ± 51.41 | 224.07 ± 41.4  |         | 163.06 ± 42.45 | <0.001** |
| Range                            | 20-300         | 130-300        |         | 20-200         |          |

\*p<0.05 is statistically significant; \*\*p ≤ 0.001 is statistically highly significant; °Chi square test; #Independent sample t test

**Table 2:** Correlations between total gastrectomy and distal gastrectomy for treatment of distal gastric cancer regarding postoperative complications and patient outcome (recurrence and death).

| Variables                               | Total         | Surgical Techniques |                    | p      |
|---|---------------|---------------------|--------------------|--------|
|   |               | Total gastrectomy   | Distal gastrectomy |        |
|   | N=30 (%)      | N=15 (%)            | N=15 (%)           |        |
| <b>Postoperative complication</b>       |               |                     |                    |        |
| Absent                                  | 24 (80)       | 11 (45.8)           | 13 (54.2)          | 0.651  |
| Present                                 | 6 (20)        | 4 (66.7)            | 2 (33.3)           |        |
| <b>Postoperative wound infection</b>    |               |                     |                    |        |
| Absent                                  | 18 (60)       | 5 (27.8)            | 13 (72.2)          |        |
| Present                                 | 12 (40)       | 10 (83.3)           | 2 (16.7)           | 0.008* |
| <b>Recurrence</b>                       |               |                     |                    |        |
| Absent                                  | 10 (33.3)     | 1 (10)              | 9 (90)             |        |
| Present                                 | 20 (66.7)     | 14 (70)             | 6 (30)             | 0.002* |
| <b>Death</b>                            |               |                     |                    |        |
| No                                      | 16 (53.3)     | 4(22.5)             | 12 (80)            |        |
| Yes                                     | 14 (46.7)     | 11(77.5)            | 3 (20)             | 0.005* |
| <b>Time to start liquid diet(hours)</b> |               |                     |                    |        |
| Mean ± SD                               | 3.87 ± 0.5    | 4.01 ± 0.54         | 2.73 ± 0.43        | 0.008* |
| Range                                   | 5-Feb         | 5-Apr               | 3-Feb              |        |
| <b>Post op hospital stay (days)</b>     |               |                     |                    |        |
| Mean ± SD                               | 7.37 ± 1.54   | 8.07 ± 1.84         | 6.07 ± 1.84        | 0.005  |
| Range                                   | 11-May        | 9-May               | 11-May             |        |
| <b>Recurrence free survival</b>         |               |                     |                    |        |
| Median                                  | 28.53 ± 15.12 | 18.2 ± 15.46        | 28.87 ± 15.32      | 0.009  |
| Range                                   | Jul-58        | 28-Jul              | May-58             |        |
| <b>Overall survival</b>                 |               |                     |                    |        |
| Median                                  | 30.2 ± 13.91  | 22.2 ± 14.15        | 30.2 ± 14.15       | 0.003* |
| Range                                   | Nov-58        | Aug-38              | Nov-58             |        |

\*p<0.05 is statistically significant; \*\*p ≤ 0.001 is statistically highly significant; °Mann Whitney test; °Chi square test; #Independent sample t test

care, adequate pain control with only oral analgesia, proper condition of the wound, removing the drainage tube, absence of postoperative infections or other complications, normal laboratory tests and patient acceptance of discharge. We carried out adjuvant chemotherapy with cisplatin or 5-fluorouracil-based therapy in patients who have pathological T3/4 or lymph nodes metastasis. But we have not used radiotherapy for any patients in our study. We recorded and analyzed different clinic-pathological information as age and sex of the patients, size, site, histopathological subtype, depth of invasion of the tumor, lymph node metastasis, resection margins, pathological stage, duration of the operation, amount of intra-operative blood loss, postoperative complications, reoperation, duration of postoperative hospital stay, recurrence and survival outcome.

We followed-up all patients for 5 years from March 2014 to

March 2019. The last follow-up time was on March 2019.

**Statistical analysis**

All collected data were processed and statistically analyzed using SPSS Inc 22.0 for Windows. We analyzed the discrete variables using the Chi-square test or Fisher’s exact test. We analyzed disease free and overall survival rates were analyzed using the Kaplan–Meier method and were compared using the log-rank test. We considered p value as significant if it was less than 0.5.

**Results**

The current study included thirty patients with histologically confirmed adenocarcinoma of the stomach located in the distal third. Patients were divided into twenty two (73.3%) males and twenty (66.7%) females.

**Table 3:** Comparison between the studied groups regarding recurrence free survival and overall survival.

| Time | Initial Management techniques |      |                    |      | Mantel Cox test |
|------|-------------------------------|------|--------------------|------|-----------------|
|      | Total gastrectomy             |      | Distal gastrectomy |      |                 |
|      | Mean                          | SEM  | Mean               | SEM  | P               |
| RFS  | 21.28                         | 2.01 | 38.73              | 4.89 | 0.018*          |
| OS   | 30.88                         | 4.03 | 51                 | 4.17 | 0.043*          |

There were no significant correlations were found between both groups that underwent different surgical techniques regarding; patients' age or sex, presence of comorbid conditions, size, histological subtype, grade and stage of the tumor or negative excision margin. Demographic, histological and operative details of included patients were found in Table 1.

### Operative and post-operative details of patients in both studied groups

The total gastrectomy has a longer duration of the operation, a larger amount of intra-operative blood loss ( $p < 0.001$ ), longer duration before starting diet ( $P = 0.008$ ), and longer duration of staying at hospital after the operation ( $P = 0.005$ ) than the distal gastrectomy group (Table 2).

Postoperative complication rate was lower in the distal gastrectomy group, but it was not significant. Wound complications were lower in the group of patients who underwent distal gastrectomy ( $p = 0.008$ ).

### Recurrence and survival results

Patients who underwent distal gastrectomy has a lower incidence of cancer recurrence ( $p = 0.002$ ), lower incidence of mortality ( $p = 0.005$ ), favorable recurrence free ( $p = 0.009$ ) and overall survival rates ( $p = 0.003$ ), than patients who underwent total gastrectomy (Table 2 and Figure 1).

## Discussion

There are improvement in the management strategies of gastric cancer due to advanced surgical techniques, experiences and usage of chemotherapy which leads to increased survival rates of patients, so the long term quality of life and nutritional status of surgically operated gastric cancer patients become very important. It is still controversial whether to perform distal or total gastrectomy for gastric cancer patients. Differences between both techniques have been mentioned by many previous studies regarding; operative, post-operative and long term survival advantages but accurate sharp results could not be reached [4].

In the current prospective study we have tried to assess the best surgical procedure for management of patients with cancer in the distal part of the stomach.

We found that distal gastrectomy has a longer operation time, larger amount of intraoperative blood loss, longer duration of post-operative hospital stay, recurrence and mortality than distal gastrectomy, more over total gastrectomy was associated with miasmal patients outcome, quality of life and unfavorable survival rate in comparison with distal gastrectomy. Many previous studies showed similar results [2,4,8,9]. These previous studies have showed that total gastrectomy was not superior to distal gastrectomy in management of patients with distal gastric cancer.

Kong et al. [9], study showed that the rate of postoperative

complications and 5-year survival rate in patients who underwent total gastrectomy were similar to patients who underwent distal gastrectomy, but they showed that distal gastrectomy was associated with less anastomotic fistula and lower rate of recurrence when compared to total gastrectomy. Moreover, Xu et al. [8], showed that distal gastrectomy was found to be superior to total gastrectomy in many parameters as; shorter time of the operation, lower amount of intraoperative loss of blood, and shorter duration of staying at hospital after the operation.

We showed that the advantage of total gastrectomy that it has a larger number of surgically excised lymph nodes that lead to better surgical staging. However, we found that distal gastrectomy is better than total gastrectomy regarding favorable long-term nutritional status. There are many explaining reasons. First, in distal gastrectomy we preserved the region of gastric fundic gland that secretes gastric acid and intrinsic factors, so patients would not be liable to vitamin B12 deficiency, which is showed by Hu et al. [10]. Second, in distal gastrectomy we preserved the duodenum which plays an essential role in dietary iron absorption [11]. Third, the immunologic function is closely associated with body weight, and the reduction of more than five percent of body weight leads to decreased immunity and increased the toxicity of adjuvant chemotherapeutic agents [12].

Despite all the previously mentioned advantages of distal gastrectomy regarding better nutritional status, but there is still a higher incidence of postoperative occurrence of stenosis at site of the anastomosis and reflux esophagitis. Similar to us, Results of Liu et al. [2], study showed that the 5-year survival rates after performing distal gastrectomy was more favorable than that of total gastrectomy in management of distal gastric cancer patients. The dismal rates of survival after total gastrectomy might be attributed to the higher tumor stage. Total gastrectomy was found to have many complications as marked weight loss with subsequent reduction in the immunologic function, anorexia, diarrhea and metabolic changes [13]. Different from us are those of Kong et al. [9], meta-analysis who showed that there were no significant differences in postoperative complications between the groups that underwent either distal or total gastrectomy, although total gastrectomy was a prolonged and more complex surgical procedure.

## Conclusion

In the present prospective study we stated that distal gastrectomy was a feasible ad more safe surgical procedure than total gastrectomy for management of distal gastric cancer as regard; operative, post-operative, long term patients' nutritional status, outcome and survival.

## Recommendation

We recommended performing distal gastrectomy as the optimal surgical procedure for distal gastric cancer under the premise of negative resection margin.

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