Research Article

Omental Bursectomy: Operative Safety and Oncologic Effectiveness in Patients with Advanced Gastric Cancer

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Abstract

Background: Gastric cancer is commonly treated with D2 gastrectomy, but the additional oncologic benefit of omental bursectomy remains controversial because of uncertain survival benefit and potential operative morbidity. Objective: To evaluate the operative safety and oncologic effectiveness of omental bursectomy in patients with advanced gastric cancer, with particular emphasis on locoregional control and recurrence-free survival. Methods: This prospective cohort study was conducted at the Department of Surgical Oncology, National Cancer Institute (NCI), Cairo University. Patients with histologically confirmed gastric adenocarcinoma who were considered candidates for curative-intent gastrectomy with D2 lymph node dissection and omental bursectomy were prospectively enrolled over a 24-month recruitment period. Results: The study included 45 patients, predominantly males. Mean operative time was 248.6 minutes and blood loss was 644.4 mL. Wound infection was the most common complication, while pancreatic and gastric leaks occurred in 4.4% and 8.8%, respectively. All bursectomy specimens and peritoneal cytology were negative for malignancy. At two years, 77.8% remained recurrence-free, while 22.2% developed recurrence, mainly distant metastasis. Conclusion: Omental bursectomy with D2 gastrectomy showed acceptable operative safety and satisfactory locoregional control, with a 2-year recurrence rate of 22.2%. However, its independent oncologic benefit remains uncertain in the absence of a non-bursectomy control group.

Keywords: Gastric cancer, Omental bursectomy, D2 gastrectomy, Operative safety, Locoregional control, Recurrence-free survival, Peritoneal recurrence.

1. Introduction

Gastric cancer remains a major cause of cancer-related mortality worldwide, with more than one million new cases reported annually [1]. For patients with locally advanced resectable disease, curative-intent gastrectomy with adequate lymph node dissection remains the cornerstone of treatment [2,3].

D2 lymph node dissection is currently considered the standard surgical approach for locally advanced gastric cancer [2,3]. Historically, radical gastrectomy also included omentectomy and bursectomy; however, the oncologic value of bursectomy has become increasingly controversial [4].

Bursectomy involves removal of the peritoneal lining over the pancreas and transverse mesocolon. Its proposed oncologic benefit is based on eliminating microscopic tumor deposits within the lesser sac and improving clearance of subpyloric lymphatic tissue [5]. Nevertheless, this potential benefit must be balanced against greater operative complexity and possible perioperative morbidity, particularly with minimally invasive approaches [7].

Recent guidelines have progressively limited the routine use of bursectomy. The Japanese Gastric Cancer Treatment Guidelines no longer consider it an essential component of standard radical gastrectomy [8], while the NCCN guidelines regard extended peritoneal resection as having unproven benefit [9]. Moreover, the JCOG1001 randomized trial did not demonstrate a clear survival advantage from bursectomy, even in patients with serosal involvement [10].
The present study aimed to evaluate the operative safety and oncologic effectiveness of omental bursectomy in patients with advanced gastric cancer, with particular emphasis on locoregional control and recurrence-free survival.

2. Patients and Methods

This prospective cohort study was conducted at the Department of Surgical Oncology, National Cancer Institute (NCI), Cairo University. Patients with histologically confirmed gastric adenocarcinoma who were considered candidates for curative-intent gastrectomy with D2 lymph node dissection and omental bursectomy were prospectively enrolled over a 24-month recruitment period.

2.1 Inclusion Criteria

Eligible patients had histologically confirmed gastric adenocarcinoma with potentially curative disease staged as T2–T4, N0–N3, M0. Patients were required to be younger than 80 years, have an American Society of Anesthesiologists (ASA) physical status of I–III, and have no significant respiratory, urinary, or cardiovascular compromise. Previous neoadjuvant chemotherapy or chemoradiotherapy was permitted.

2.2 Exclusion Criteria

Patients were excluded if they had severe comorbidities precluding extended surgical resection, peritoneal carcinomatosis, liver metastases or hepatic invasion, esophageal invasion requiring additional surgical procedures, non-adenocarcinoma histology on final pathological examination, remnant gastric cancer, or synchronous malignancies.

2.3 Preoperative Assessment

All patients underwent comprehensive clinical and radiological evaluation before surgery. Assessment included clinical examination, complete blood count, biochemical investigations, chest radiography, and contrast-enhanced thoracoabdominal computed tomography to evaluate the primary tumor, serosal involvement, nodal disease, distant metastases, and possible peritoneal dissemination. Upper gastrointestinal endoscopy was performed to define tumor location, size, macroscopic appearance, and associated complications, with biopsy obtained for histopathological confirmation. Staging laparoscopy was selectively performed in patients considered at increased risk of occult peritoneal carcinomatosis when CT findings were inconclusive.

2.4 Surgical Procedure

All patients underwent curative-intent gastrectomy with D2 lymph node dissection and omental bursectomy through either an open or laparoscopic approach, according to tumor characteristics and operative considerations. Following abdominal exploration to exclude occult metastatic or unresectable disease, the greater omentum was mobilized and the avascular plane between the posterior omentum and the anterior surface of the transverse mesocolon was identified. The lesser sac was entered, and the peritoneal lining over the anterior transverse mesocolon and pancreatic surface was dissected en bloc with the specimen while preserving the middle colic vessels and pancreatic parenchyma. The dissection was extended along the pancreatic surface and the fascia of Treitz was divided to complete removal of the omental bursa.

2.5 D2 Lymphadenectomy and Gastric Resection

D2 lymphadenectomy was performed together with the gastric resection. Infrapyloric and suprapyloric nodal dissection included clearance around the right gastroepiploic and right gastric vessels, followed by dissection along the left gastric artery, common hepatic artery, celiac axis, and proximal splenic artery. Appropriate nodal stations were cleared according to the extent and location of the tumor, with additional splenic hilar and distal splenic artery lymph-node dissection performed when indicated in patients undergoing total gastrectomy. Distal or total gastrectomy was selected according to tumor location and the ability to achieve adequate oncologic margins, with preservation of the pancreas and spleen unless directly invaded by the tumor.

2.6 Reconstruction

After completion of resection and confirmation of adequate surgical margins, gastrointestinal continuity was restored according to the type of gastrectomy. Roux-en-Y esophagojejunostomy was used following total gastrectomy, whereas Roux-en-Y or Billroth II gastrojejunostomy was performed following distal gastrectomy. Anastomotic technique was selected according to the operative approach, surgeon preference, and intraoperative findings. Feeding jejunostomy and intra-abdominal drainage were used selectively when clinically indicated.

2.7 Operative Data

Perioperative data were prospectively recorded for each patient, including demographic characteristics, receipt of neoadjuvant treatment, type and extent of gastrectomy, operative approach, duration of surgery, estimated intraoperative blood loss, extent of lymphadenectomy, additional surgical procedures, and intraoperative complications. These parameters were evaluated to assess the operative safety of omental bursectomy.

2.8 Pathological Examination

Resected specimens, including the stomach, lymph nodes, omental bursa, and available peritoneal washings, were submitted for histopathological examination. Pathological assessment included tumor location and size, depth of invasion, histological type and grade of differentiation, vascular and perineural invasion, proximal and distal resection margins, total and metastatic lymph-node counts, involvement of the omental bursa, and cytological examination of peritoneal washings when available. Pathological staging was performed according to the eighth edition of the Tumor–Node–Metastasis classification system.

2.9 Follow-Up

Patients were followed for up to 24 months after surgery to detect postoperative complications and disease recurrence. Follow-up assessment focused on the development of locoregional recurrence or distant metastasis and on complications potentially related to the surgical procedure, including pancreatic injury, intestinal obstruction or adhesions, afferent loop syndrome, delayed gastric emptying, and other postoperative morbidity.

2.10 Outcome Measures

The primary oncologic outcome was recurrence-free survival, assessed according to the occurrence of locoregional recurrence or distant metastasis during follow-up. Operative safety constituted an additional major outcome and was evaluated using intraoperative parameters and postoperative morbidity and mortality, with particular attention to complications potentially attributable to the surgical procedure.

2.11 Sample Size

Based on the expected surgical volume of the department and the predefined eligibility criteria, a minimum sample of 40 patients was targeted for enrollment during the 24-month recruitment period.

2.13 Statistical Analysis

Data were analyzed using IBM SPSS Statistics version 23. Continuous variables were presented as mean ± standard deviation or median with interquartile range, while categorical variables were expressed as frequencies and percentages. Student's t-test or Mann–Whitney U test was used for two-group comparisons, while one-way ANOVA or Kruskal–Wallis test was used for comparisons among multiple groups. Pearson's or Spearman's correlation was applied as appropriate, and categorical variables were compared using the chi-square test or Fisher's exact test. A p-value <0.05 was considered statistically significant.

3. Results

The most common age group among the study population was 50 – 60 years, representing 40.0% of the patients. The overall age range was 32 to 80 years. Regarding sex distribution, males were more prevalent, with a male-to-female ratio of approximately 2.5:1. Table 1

Table 1: Demographic data distribution among study group.

Demographic data	No.	%
Age "years"		
≤40 years	7	15.6%
40–50 years	7	15.6%

50–60 years	18	40.0%
60–70 years	9	20.0%
70–80 years	4	8.9%
Sex		
Female	13	28.9%
Male	32	71.1%

The mean intraoperative blood loss among the study group was 644.44 ± 120.24 mL, with a range of 450 to 950 ml. The mean operative time was 248.64 ± 21.26 minutes, ranging from 220 to 320 minutes. Table 2

Table 2: Intraoperative data description among study group.

Demographic data	No.	%
Age "years"		
≤40 years	7	15.6%
40–50 years	7	15.6%
50–60 years	18	40.0%
60–70 years	9	20.0%
70–80 years	4	8.9%
Sex		
Female	13	28.9%
Male	32	71.1%

This table details the distribution of perioperative morbidity stratified by gastrectomy type. Major complications occurred exclusively in patients undergoing total gastrectomy, with a pancreatic leak rate of 4.4% (2 of 45 patients) and a gastric leak rate of 8.8% (4 of 45 patients). No major anastomotic or pancreatic leaks were recorded in the subtotal gastrectomy cohort. In contrast, the most common minor complication was wound infection, affecting 31.1% of all patients (14 of 45). This complication was more prevalent following total gastrectomy (n=11) compared to subtotal gastrectomy (n=3). The data suggest a distinct morbidity profile; wherein total gastrectomy is associated with a higher incidence of both major organ-specific complications and minor infectious complications compared to the subtotal procedure. Table 3

Table 3: Perioperative morbidity distribution among study group.

Demographic data	No.	%
Age "years"		
≤40 years	7	15.6%
40–50 years	7	15.6%
50–60 years	18	40.0%

60–70 years	9	20.0%
70–80 years	4	8.9%
Sex		
Female	13	28.9%
Male	32	71.1%

The findings regarding peritoneal involvement for the entire study cohort (n=45). Pathological examination of the omental bursectomy specimen and peritoneal cytology washings were uniformly negative in all 45 patients (100.0%). This indicates an absence of microscopic or cytological evidence of peritoneal metastasis in the assessed cohort. However, gross pathological involvement of the greater omentum was identified in 2 patients (4.4%), while the remaining 43 patients (95.6%) had a negative greater omentum. Table 4

Table 4: Peritoneal involvement distribution among study group.

Peritoneal involvement	No.	%
Pathology of omental bursectomy		
Negative	45	100.0%
Positive	0	0.0%
Cytology		
No	45	100.0%
Yes	0	0.0%
Greater omentum positive		
No	43	95.6%
Yes	2	4.4%

The lymph node analysis revealed that the mean number of positive lymph nodes was 3.58±4.85, with a range of 0 to 16, while the mean total number of lymph nodes was 30.09±11.56, with a range of 10 to 67, providing insights into the extent of lymph node involvement in patients with advanced gastric cancer undergoing omental bursectomy. Table 5

Table 5: LN distribution among study group.

LN	Total (n=45)
Positive number of lymph node	
Mean ±SD	3.58±4.85
Range	0-16
Total number of lymph node	
Mean ±SD	30.09±11.56
Range	10-67

The pathological TNM staging distribution for the study cohort (n=45). The T-stage analysis reveals that the majority of tumors were locally advanced, with T3 lesions being the most prevalent (40.0%), followed by T2 (20.0%). Notably, a significant proportion of patients (17.8%) were classified as T0, indicative of a complete pathological response. Early T-stage tumors (T1) constituted the smallest group (6.7%). Nodal staging showed a bimodal distribution. Nearly half of

the patients (48.9%) had no nodal metastasis (N0). Conversely, advanced nodal disease (N3) was present in 24.4% of the cohort, representing the most common category among node-positive patients. The remaining patients were distributed across N1 (13.3%) and N2 (13.3%) stages. Together, this profile depicts a cohort characterized by a significant burden of locally advanced primary tumors (T2-T4: 75.6%) and a high rate of either no nodal involvement or, conversely, extensive nodal disease. Table 6

Table 6: TNM staging distribution among study group.

TNM staging	No.	%
T stage		
T0	8	17.8%
T1	3	6.7%
T2	9	20.0%
T3	18	40.0%
T4	7	15.6%
N stage		
N0	22	48.9%
N1	6	13.3%
N2	6	13.3%
N3	11	24.4%

Among the study cohort (n=45), 10 patients (22.2%) experienced disease recurrence, while 35 patients (77.8%) remained recurrence-free at the two-year follow-up. The most frequent type of recurrence was metastatic disease to distant organs, accounting for half of all recurrence events (5/10 patients, or 11.1% of the total cohort). Peritoneal recurrence was the second most common type, occurring in 3 patients (6.7%). Local recurrence at the primary surgical site and isolated nodal recurrence were less common, observed in 2 (4.4%) and 1 (2.2%) patient, respectively. Recurrence sites may overlap in some patients. Table 7

Table 7: Recurrence 2 years' distribution among study group.

TNM staging	No.	%
T stage		
T0	8	17.8%
T1	3	6.7%
T2	9	20.0%
T3	18	40.0%
T4	7	15.6%
N stage		

N0	22	48.9%
N1	6	13.3%
N2	6	13.3%
N3	11	24.4%

4. Discussion

The majority of patients were male (71.1%), yielding a male-to-female ratio of approximately 2.5:1, and the most frequent age group was 50–60 years (40%). The overall age range was 32–80 years, confirming the predominance of gastric cancer among middle-aged and older adults.

The mean operative time was 248.6 ± 21.3 minutes and the mean intraoperative blood loss was 644 ± 120 mL. These values were comparable with open D2 gastrectomy results reported by Kim et al. [11]. The blood loss was somewhat higher than that reported by Chen et al. [12] and Chen et al. [13], possibly reflecting the complexity of total gastrectomies and advanced-stage tumors in this cohort.

Postoperative morbidity occurred in 15 patients (33.3%). The most common complication was wound infection, affecting 14 patients (31.1%). Major complications included pancreatic leak in 4.4% and gastric leak in 8.8%. These incidences were higher than some reported series, although they remain within the range described in complex advanced cases [14,15]. Bursectomy involves dissection along the anterior pancreatic capsule and has been associated with an increased risk of postoperative pancreatic fistula. Kurokawa et al. [10] reported a higher incidence of postoperative pancreatic fistula following bursectomy.

Pathological staging showed a predominance of T3 disease, accounting for 40% of patients. Nearly half of the patients were N0 (48.9%), while N3 disease was present in 24.4% of the cohort. This distribution reflects the advanced pathological stage of a substantial proportion of the studied patients.

The mean number of positive lymph nodes was 3.58 ± 4.85, while the mean total number of retrieved lymph nodes was 30.09 ± 11.56. The lymph-node yield exceeded the minimum number required for adequate pathological staging and approached the threshold associated with improved staging accuracy. Similar nodal yields were reported by Macalindong et al. [16] and Song et al. [17].

A principal pathological finding was the uniform negativity of peritoneal cytology and omental bursectomy specimens, both of which were negative for malignancy in all 45 patients. Gross involvement of the greater omentum was identified in only two patients (4.4%). The absence of microscopic disease in the bursa may suggest limited additional therapeutic benefit from routine bursectomy in patients with negative cytology and no gross omental involvement. This interpretation is supported by the JCOG1001 trial reported by Kurokawa et al. [10], which found no survival difference between patients who underwent bursectomy and those who did not during gastrectomy for cT3/T4a tumors. However, the universal negativity may also reflect the effect of neoadjuvant chemotherapy, as Yoshikawa et al. [18] demonstrated that neoadjuvant treatment may reduce positive peritoneal cytology. The low rate of gross omental involvement was also consistent with previously reported series [19,20].

During the two-year follow-up, recurrence occurred in 10 patients (22.2%). Distant metastasis was the most frequent pattern of recurrence (11.1%), followed by peritoneal recurrence (6.7%), local recurrence (4.4%), and nodal recurrence (2.2%). The 2-year disease-free survival rate was 77.8%, with a median disease-free survival of 15 months. These outcomes were comparable with previously reported gastric cancer series [5]. The predominance of distant metastasis as the first site of failure was also reported in previous studies [5,19].

5. Conclusion

Omental bursectomy as part of D2 gastrectomy was associated with an acceptable operative morbidity profile and no operative mortality in this cohort. Oncologically, all bursectomy specimens and peritoneal cytology samples were negative for malignancy, while the 2-year recurrence rate was 22.2%, with relatively low local and peritoneal recurrence. These findings suggest satisfactory locoregional control; however, the absence of a non-bursectomy comparison group limits assessment of the independent oncologic benefit of bursectomy.

- **Recommendations**

  Omental bursectomy should not be considered a routine component of gastrectomy for all patients with advanced gastric cancer. A selective approach may be more appropriate, particularly in patients with suspected serosal or posterior gastric wall involvement or visible omental disease. High-quality D2 lymphadenectomy and multimodal treatment should remain the main components of management, while larger comparative studies with longer follow-up are needed to clarify the specific oncologic value of bursectomy.

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