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# Research on the Impact of Different Lymph Node Dissection Scopes on Postoperative Recurrence and Survival Rates in Patients with Early Gastric Cancer

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**Abstract:** *Objective*: To investigate the impact of different lymph node dissection scopes on postoperative recurrence and survival rates in patients with early gastric cancer, providing evidence-based support for optimizing clinical surgical plans. *Methods*: A retrospective analysis was conducted on the clinical data of 100 patients with early gastric cancer who underwent surgical treatment at our hospital from October 2021 to October 2023. Patients were divided into Group D1 ($n$ = 50) and Group D2 ($n$ =50) based on the extent of lymph node dissection. Group D1 underwent limited lymph node dissection (dissection of the first station of lymph nodes around the stomach), while Group D2 underwent standard lymph node dissection (dissection of the first and second stations of lymph nodes around the stomach). Surgical-related indicators, the incidence of postoperative complications, the 2-year recurrence rate, and the 2-year survival rate were compared between the two groups of patients. *Results*: The operative time, intraoperative blood loss, postoperative hospital stay, and the number of lymph nodes dissected were significantly higher in the D2 group than in the D1 group (all $P < 0.001$). The overall incidence of postoperative complications was higher in the D1 group than in the D2 group, but the difference was not statistically significant ($\chi^2 = 0.884$, $P = 0.766$). After a 2-year follow-up, the recurrence rate was significantly higher in the D1 group than in the D2 group ($\chi^2 = 4.000$, $P = 0.046$). The 2-year survival rate was significantly lower in the D1 group than in the D2 group ($\chi^2 = 5.005$, $P = 0.025$). A total of 100 patients with early-stage gastric cancer were grouped according to the depth of invasion, degree of differentiation, and lymph node metastasis status, and the recurrence rates of different subgroups were compared. The results showed that the recurrence rate was higher in patients with T1b stage than in those with T1a stage ($\chi^2 = 5.005$, $P = 0.025$), higher in poorly differentiated patients than in moderately and well-differentiated patients ($\chi^2 = 4.155$, $P = 0.042$), and higher in patients with lymph node metastasis than in those without lymph node metastasis ($\chi^2 = 4.512$, $P = 0.034$). *Conclusion*: Compared with D1 limited lymph node dissection, D2 standard lymph node dissection can significantly reduce the postoperative recurrence rate and improve the 2-year survival rate in patients with early-stage gastric cancer without significantly increasing the risk of postoperative complications. Although the surgical trauma is slightly greater, the overall prognosis is better, making it a preferred surgical treatment option for patients with early-stage gastric cancer.

**Keywords:** Early-stage gastric cancer; Extent of lymph node dissection; D1 dissection; D2 dissection; Recurrence rate; Survival rate

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# 1. Introduction

Gastric cancer is a common malignant tumor of the digestive system worldwide, ranking among the top in both incidence and mortality rates among malignant tumors, and posing a serious threat to human life and health [1]. Early-stage gastric cancer refers to tumors with infiltration depth limited to the mucosal layer or submucosal layer, regardless of the presence of lymph node metastasis [2]. With the widespread adoption of gastroscopy screening techniques, the detection rate of early-stage gastric cancer has been increasing annually, with surgical treatment being the preferred radical approach. Lymph node metastasis is a significant risk factor for postoperative recurrence and poor prognosis in gastric cancer patients, so the quality of lymph node dissection directly impacts the patient's treatment outcomes and long-term prognosis. Currently, there is still controversy regarding the extent of lymph node dissection for patients with early-stage gastric cancer. D1 dissection (limited lymph node dissection) involves the removal of only the first-tier lymph nodes around the stomach, resulting in less surgical trauma but potentially leaving behind micrometastases due to incomplete dissection, thereby increasing the risk of postoperative recurrence. D2 dissection (standard lymph node dissection) requires the removal of both the first- and second-tier lymph nodes around the stomach, enabling a more thorough clearance of potentially metastatic lymph nodes and reducing the risk of recurrence, but it involves greater surgical trauma and may increase the incidence of postoperative complications. Therefore, balancing surgical trauma with prognostic benefits is crucial in determining the extent of lymph node dissection for early-stage gastric cancer.

# 2. Materials and methods

## 2.1. General information

A retrospective study was conducted on 100 patients with early-stage gastric cancer who underwent surgical treatment in the Department of Gastrointestinal Surgery at our hospital from October 2021 to October 2023. Inclusion criteria were as follows: (1) Postoperative pathology confirmed gastric cancer with infiltration depth limited to the mucosal layer (T1a) or submucosal layer (T1b), meeting the diagnostic criteria for early-stage gastric cancer [3]; (2) No adjuvant therapy, such as radiotherapy, chemotherapy, or targeted therapy, was administered before surgery; (3) Complete clinical data were available, enabling a 2-year follow-up; (4) Informed consent was obtained from both patients and their families, and the study was approved by the hospital's ethics committee. Exclusion criteria included: (1) Presence of other malignancies; (2) Severe dysfunction of vital organs, including the heart, liver, or kidneys; (3) Discovery of distant metastasis or non-resectable tumors during surgery; (4) Loss to follow-up or death from non-tumor-related causes during the follow-up period.

Patients were divided into Group D1 and Group D2 based on the extent of lymph node dissection, with 50 patients in each group. In Group D1, there were 28 males and 22 females, aged between 42 and 76 years old, with an average age of (58.62 ± 8.35) years old. Tumor locations included 12 cases in the gastric cardia,

18 in the gastric body, and 20 in the gastric antrum. Infiltration depth comprised 26 cases at T1a stage and 24 at T1b stage. Differentiation grades included 22 well-differentiated, 19 moderately differentiated, and 9 poorly differentiated cases. Regarding lymph node metastasis, 15 cases had metastasis, while 35 did not. In Group D2, there were 26 males and 24 females, aged between 40 and 78 years, with an average age of (59.15 ± 8.67) years. Tumor locations included 10 cases in the gastric cardia, 20 in the gastric body, and 20 in the gastric antrum. Infiltration depth comprised 24 cases at T1a stage and 26 at T1b stage. Differentiation grades included 20 well-differentiated, 21 moderately differentiated, and 9 poorly differentiated cases. Regarding lymph node metastasis, 16 cases had metastasis, while 34 did not. No statistically significant differences were observed in general information such as gender, age, tumor location, depth of invasion, degree of differentiation, and lymph node metastasis between the two groups of patients ($P > 0.05$), indicating comparability.

## 2.2. Surgical methods

For both groups of patients, the surgical approach was selected based on the tumor location (distal gastrectomy, proximal gastrectomy, or total gastrectomy), and all surgeries were performed by the same experienced surgical team.

In Group D1, limited lymph node dissection was performed, involving only the removal of the first-tier lymph nodes around the stomach (corresponding to different stomach regions: for the gastric fundus and cardia, groups 1, 2, 3, 4sa, and 4sb; for the gastric body, groups 1, 3, 4sb, 5, and 6; and for the gastric antrum, groups 3, 4d, 5, and 6).

In Group D2, standard lymph node dissection was carried out, which, in addition to the D1 dissection, included the removal of the second-tier lymph nodes around the stomach (corresponding to different stomach regions: for the gastric fundus and cardia, groups 7, 8a, 9, 10, and 11; for the gastric body, groups 7, 8a, 9, and 11; and for the gastric antrum, groups 7, 8a, 9, and 12a), ensuring that the number of lymph nodes dissected was ≥ 15.

## 2.3. Observation indicators and follow-up

(1) Surgical-related indicators: The surgical time, intraoperative blood loss, postoperative hospital stay, and the number of lymph nodes dissected were recorded for both groups of patients.

(2) Postoperative complications: Complications occurring within 30 days postoperatively were observed and recorded, including wound infection, abdominal infection, anastomotic leakage, delayed gastric emptying, intestinal obstruction, etc., and the severity of complications was assessed.

(3) Recurrence and survival status: Patients were followed up for two years through outpatient reviews and telephone follow-ups after surgery, with the follow-up ending in October 2025. Reviews were conducted every three months, including blood tests, tumor markers (CEA, CA19-9), gastroscopy, abdominal CT, etc. The time of tumor recurrence, the site of recurrence, and the survival status of patients were recorded. Recurrence was defined as the presence of new tumor lesions confirmed by imaging or pathological examination after surgery; survival rate was calculated as the proportion of patients still alive at the end of the follow-up period.

## 2.4. Statistical methods

Data analysis was performed using SPSS 26.0 statistical software. Measurement data were expressed as mean ±

standard deviation (SD), and comparisons between groups were made using independent sample t-tests. Count data were expressed as the number of cases (percentage) [*n* (%)], and comparisons between groups were made using the $\chi^2$ test. A *P*-value < 0.05 was considered statistically significant.

# 3. Results

## 3.1. Comparison of surgical indicators between the two groups of patients

The surgical duration, intraoperative blood loss, postoperative hospital stay, and number of lymph nodes dissected were significantly higher in the D2 group than in the D1 group (all $P < 0.001$). See **Table 1**.

**Table 1.** Comparison of surgical indicators between the two groups of patients

| Group | Operative Time (min) | Intraoperative Blood Loss (ml) | Postoperative Hospital Stay (days) | Number of Lymph Nodes Dissected |
|---|---|---|---|---|
| D1 Group ($n = 50$) | 128.56 ± 23.45 | 85.32 ± 21.67 | 7.24 ± 1.89 | 8.62 ± 2.15 |
| D2 Group ($n = 50$) | 186.78 ± 31.24 | 132.56 ± 30.45 | 9.56 ± 2.34 | 18.95 ± 3.67 |
| *t*-value | 10.539 | 8.938 | 5.454 | 17.234 |
| *P*-value | < 0.001 | < 0.001 | < 0.001 | < 0.001 |

## 3.2. Comparison of postoperative complication rates between the two groups of patients

The overall incidence of postoperative complications was higher in the D1 group than in the D2 group, but the difference was not statistically significant ($\chi^2 = 0.884$, $P = 0.766$). See **Table 2**.

**Table 2.** Comparison of postoperative complications between the two groups of patients

| Group | Incision Infection | Abdominal Infection | Delayed Gastric Emptying | Anastomotic Leak | Intestinal Obstruction | Total Incidence (%) |
|---|---|---|---|---|---|---|
| D1 Group ($n = 50$) | 3 (6.00) | 2 (4.00) | 2 (4.00) | 0 (0.00) | 0 (0.00) | 7 (14.00) |
| D2 Group ($n = 50$) | 2 (4.00) | 1 (2.00) | 2 (4.00) | 1 (2.00) | 0 (0.00) | 6 (12.00) |
| $\chi^2$ | | | | | | 0.884 |
| *P*-value | | | | | | 0.766 |

## 3.3. Comparison of recurrence rate and survival rate between the two groups of patients two years after surgery

After two years of follow-up, the recurrence rate in Group D1 was significantly higher than that in Group D2 ($\chi^2 = 4.000$, $P = 0.046$); the two-year survival rate in Group D1 was significantly lower than that in Group D2 ($\chi^2 = 5.005$, $P = 0.025$). See **Table 3**.

**Table 3.** Comparison of recurrence rate and survival rate between the two groups of patients two years after surgery

| Group | Recurrence Cases (n) | Recurrence Rate (%) | Death Cases (n) | 2-Year Survival Rate (%) |
|---|---|---|---|---|
| D1 Group | 8 | 16.00 | 9 | 82.00 |
| D2 Group | 2 | 4.00 | 2 | 96.00 |
| $\chi^2$ | — | 4.000 | — | 5.005 |
| *P*-value | — | 0.046 | — | 0.025 |

## 3.4. Comparison of postoperative recurrence in early gastric cancer patients with different clinical characteristics

A total of 100 early gastric cancer patients were grouped according to the depth of invasion, degree of differentiation, and lymph node metastasis status, and the recurrence rates of different subgroups were compared. The results showed that the recurrence rate in patients at stage T1b was higher than that in patients at stage T1a ($\chi^2 = 5.005$, $P = 0.025$), the recurrence rate in poorly differentiated patients was higher than that in moderately to well-differentiated patients ($\chi^2 = 4.155$, $P = 0.042$), and the recurrence rate in patients with lymph node metastasis was higher than that in patients without lymph node metastasis ($\chi^2 = 4.512$, $P = 0.034$). See **Table 4**.

**Table 4.** Comparison of postoperative recurrence in early gastric cancer patients with different clinical characteristics

| Clinical Feature | Total Cases (n) | Recurrence Cases (n/%) | $\chi^2$ | *P*-value |
|---|---|---|---|---|
| Depth of Invasion | — | — | | |
| T1a Stage | 50 | 2 (4) | 5.005 | 0.025 |
| T1b Stage | 50 | 9 (18) | | |
| Differentiation Grade | — | — | | |
| Moderate-High | 82 | 6 (7.89) | 4.155 | 0.042 |
| Low | 18 | 6 (33.33) | | |
| Lymph Node Metastasis | — | — | | |
| Positive | 31 | 7 (21.88) | 4.512 | 0.034 |
| Negative | 69 | 3 (5.41) | | |

# 4. Discussion

The primary treatment for early gastric cancer is radical surgical resection, and lymph node dissection is an important component of the surgery, with its scope directly related to the patient's prognosis [4]. Currently, there is still controversy regarding the scope of lymph node dissection for early gastric cancer patients. This study retrospectively analyzed the clinical data of 100 early gastric cancer patients, comparing the effects of two lymph node dissection scopes, D1 and D2, on postoperative recovery and prognosis, providing data support for the selection of clinical surgical plans.

The results of this study indicate that patients in the D2 group had significantly longer operative times,

higher intraoperative blood loss, and longer postoperative hospital stays compared to those in the D1 group. This is attributed to the fact that D2 lymphadenectomy involves the dissection of more lymph node stations, making the surgical procedure more complex and causing greater trauma. However, it is noteworthy that there was no statistically significant difference in the overall incidence of postoperative complications between the two groups, suggesting that although D2 lymphadenectomy causes greater surgical trauma, it does not significantly increase the risk of postoperative complications when performed under standardized protocols [5]. This may be attributed to advancements in surgical techniques, optimization of perioperative management, and the extensive experience of the surgeons, which effectively reduce the occurrence of surgery-related complications.

Recurrence rate and survival rate are core indicators for evaluating the prognosis of patients with malignant tumors [6]. During the 2-year follow-up in this study, it was found that patients in the D1 group had a significantly higher postoperative recurrence rate compared to those in the D2 group, while the 2-year survival rate in the D1 group was significantly lower than that in the D2 group. These findings suggest that D2 standard lymphadenectomy can significantly reduce the risk of postoperative recurrence and improve long-term survival rates in patients with early-stage gastric cancer [7]. The primary reason for this is that D2 lymphadenectomy enables a more thorough clearance of potentially metastatic lymph nodes around the stomach, particularly micrometastases in the second-tier lymph nodes, thereby preventing tumor recurrence caused by residual lymph nodes [8]. Additionally, this study also found that patients with early-stage gastric cancer at stage T1b, with poorly differentiated tumors, or with lymph node metastasis had a higher recurrence rate. These patients have relatively more aggressive tumors and a higher risk of lymph node metastasis, thus necessitating a more thorough lymphadenectomy to reduce the risk of recurrence. The advantages of D2 lymphadenectomy may be more pronounced in such patients.

Regarding the selection of the extent of lymph node dissection for early-stage gastric cancer, some scholars believe that for patients with early-stage gastric cancer without lymph node metastasis, D1 dissection can meet therapeutic needs, and excessive dissection may increase surgical trauma without providing additional prognostic benefits [9]. However, in clinical practice, the accuracy of preoperative imaging in determining lymph node metastasis is limited, with a certain rate of missed diagnoses. Some patients assessed as having no lymph node metastasis preoperatively may be found to have occult lymph node metastasis upon postoperative pathological examination. D2 dissection can effectively cover these occultly metastatic lymph nodes, reducing the risk of recurrence. In this study, three patients in the D1 group who were preoperatively assessed as having no lymph node metastasis experienced recurrence postoperatively, possibly related to incomplete clearance of occult lymph node metastasis. Therefore, even for patients with early-stage gastric cancer assessed as having no lymph node metastasis preoperatively, D2 standard lymph node dissection may still hold significant prognostic value [10].

This study has certain limitations: (1) As a retrospective study, it is subject to selection bias and has a relatively limited sample size (100 cases), which may affect the objectivity of the results; (2) The follow-up period was relatively short (2 years), making it impossible to evaluate the impact of the two lymph node dissection extents on patients' long-term (5 years or more) survival rates; (3) Factors such as patients' genetic characteristics and immune function were not considered in relation to their impact on prognosis. Future research could involve prospective, large-sample clinical studies with extended follow-up periods and incorporate molecular biological indicators to further explore the impact of different lymph node dissection

extents on the prognosis of patients with early-stage gastric cancer, providing a more robust basis for the development of individualized clinical treatment plans.

## 5. Conclusion

In summary, compared to D1 limited lymph node dissection, D2 standard lymph node dissection, despite involving slightly greater surgical trauma and a marginally longer postoperative recovery time, significantly reduces the postoperative recurrence rate and improves the 2-year survival rate in patients with early-stage gastric cancer, without significantly increasing the risk of postoperative complications. Therefore, D2 standard lymph node dissection can be considered the preferred surgical treatment option for patients with early-stage gastric cancer, particularly those with deeper tumor invasion (T1b stage) or at risk of lymph node metastasis.

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## Disclosure statement

The authors .declare no conflict of interest.

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