

Role of Enteral Nutrition in Neoadjuvant Therapy for Locally Advanced Gastric Cancer with Pyloric Obstruction: A Case Series

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Abstract:

Objective: To evaluate whether neoadjuvant therapy can be carried out in pyloric obstruction secondary to gastric cancer through nasojejunal enteral nutrition and assess tumor regression and improvement in surgical outcomes.

Material and Methods: A retrospective cohort analysis of patients diagnosed with locally advanced gastric cancer (LAGC) with pyloric obstruction who received preoperative nutritional support via nasojejunal tube feeding. Once nutritional adequacy was achieved, patients proceeded to neoadjuvant therapy consisting of S-1 plus oxaliplatin (SOX chemotherapy), targeted therapy with apatinib, and immunotherapy with sintilimab. Tumor and lymph node responses were assessed radiologically and confirmed by postoperative pathological analysis.

Results: Enteral feeding was well tolerated without major complications, and all patients were able to complete the neoadjuvant regimen. Imaging showed dramatic shrinkage of the tumor mass and regression of regional lymph node enlargement. After surgery, certain cases yielded a result of complete tumor regression (Tumor Regression Grade 0) in the pathology, including resolution of lymph node metastases. Clinical results established that nutritional optimization helped in the effective downstaging of tumors and thus improved the chances of R0 resection.

Conclusion: Nasoenteric enteral nutrition is a feasible and effective method to enable the safe delivery of neoadjuvant therapy in patients with pyloric obstruction resulting from gastric cancer. It optimizes nutrition, enhances treatment tolerance, and contributes to favorable oncologic outcomes.

Keywords: enteral nutrition, gastric cancer, lymph node regression, neoadjuvant therapy, pyloric obstruction

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Introduction

Gastric cancer remains a major global health burden and ranks among the top causes of cancer-related mortality, particularly in East Asia, including countries such as China, Korea, and Japan¹⁻³. By the time of diagnosis, most patients whose tumors lie in the distal stomach and present with mechanical pyloric obstruction are already in LAGC⁴. Pyloric obstruction leads to severe nutritional deterioration and often prevents patients from receiving standard preoperative therapies⁵.

Current treatment guidelines, including those from the Japanese Gastric Cancer Association (JGCA) and the Chinese Society of Clinical Oncology (CSCO), advocate for neoadjuvant therapy in resectable or borderline resectable LAGC^{6,7}. The SOX regimen (S-1 plus oxaliplatin) has been widely accepted as the standard chemotherapy backbone, often combined with targeted agents such as apatinib and immune checkpoint inhibitors like sintilimab⁸⁻¹⁰. These regimens have demonstrated encouraging tumor regression, lymph node clearance, and survival benefits¹¹⁻¹². However, patients with gastric outlet obstruction are frequently excluded from neoadjuvant therapy because of concerns regarding tolerance and malnutrition¹³.

Surgical resection remains the conventional treatment for these patients, but upfront surgery in an obstructed, malnourished patient is associated with higher morbidity and poorer long-term survival¹⁴. Therefore, an unmet need exists to develop strategies that allow these patients to become eligible for neoadjuvant therapy, improving both their nutritional and oncologic outcomes.

In our clinical practice, we introduced nasoenteric enteral nutrition (NEEN) for patients with LAGC complicated by pyloric obstruction. Using endoscopic placement of a nasojejunal feeding tube, patients received continuous enteral feeding that bypassed the obstruction while maintaining gut function¹⁵. This approach avoided the complications of

parenteral nutrition and ensured adequate caloric intake during systemic therapy¹⁶. After nutritional recovery, patients received three cycles of SOX chemotherapy with apatinib and sintilimab, leading to substantial tumor and lymph node regression on imaging and histopathology¹⁷⁻¹⁹.

This study explores the outcomes of combining NEEN with neoadjuvant therapy to determine its clinical feasibility, safety, and therapeutic benefit. It addresses a key treatment gap and demonstrates that patients with LAGC and pyloric obstruction—traditionally excluded from preoperative therapy—can tolerate and benefit from a multimodal treatment strategy with proper nutritional support.

Material and Methods

Design of the study and patient choice

This retrospective observational study was conducted between 2024 and 2025 at the People's Hospital, in accordance with the Declaration of Helsinki, and was approved by the Institutional Ethics Committee. Written informed consent was obtained from all patients before enrollment.

Patients diagnosed with LAGC presenting with pyloric obstruction, confirmed by contrast-enhanced CT, endoscopic examination, and histopathological biopsy, were included.

Inclusion criteria were as follows:

- (1) Histologically proven adenocarcinoma of the stomach involving the pylorus;
- (2) unresectable or borderline resectable disease due to regional lymph node involvement or adjacent organ invasion;
- (3) Eastern Cooperative Oncology Group (ECOG) performance status 0–2;
- (4) inability to tolerate oral feeding due to obstruction²⁰⁻²².

Nutritional intervention: nasoenteric feeding strategy

All patients underwent nasojejunal feeding tube placement, with the distal tip positioned beyond the obstruction, usually in the jejunum. Enteral nutrition was initiated within 24 hours of placement. Feeding followed a standard protocol, using polymeric formulas adjusted to meet energy (25–30 kcal/kg/day) and protein requirements (1.2–1.5 g/kg/day)^{23–24}.

For patients requiring long-term nutritional support at home, fiber-based enteral nutrition formulas were prescribed, maintaining the same caloric target but adjusted for elderly individuals. Feeding intolerance was monitored by residual volume and gastrointestinal symptoms.

This approach preserved gastrointestinal continuity and mucosal integrity, while avoiding complications commonly associated with parenteral nutrition, such as catheter-related infections and metabolic disturbances^{25,26}. Nutritional status was monitored weekly, including albumin, prealbumin, BMI, hemoglobin, and lymphocyte count.

Neoadjuvant conversion therapy protocol

After 5 to 10 days of nasoenteric feeding, patients were stabilized with nutritional rehabilitation and underwent planned neoadjuvant conversion therapy. Of the five patients, two successfully completed three full cycles, one discontinued due to severe chemotherapy-related toxicity, one improved clinically and removed the tube without returning for treatment, and one remains under treatment.

The chemotherapy backbone was the SOX regimen (S-1 plus oxaliplatin), with S-1 (40–60 mg/m²) administered orally twice daily on Days 1 to 14, and oxaliplatin (130 mg/m² IV) on Day 1 every 3 weeks²⁷.

In addition, patients were prescribed apatinib (250 mg orally once daily) and sintilimab (200 mg IV on Day 1 every 3 weeks), in line with recent evidence suggesting synergistic anti-angiogenic and immunomodulatory effects in gastric cancer^{28–30}.

Treatment tolerance varied among cases: two patients tolerated the full protocol well, while others experienced complications such as neutropenia, recurrence of obstruction, or clinical decline. The Common Terminology Criteria for Adverse Events (CTCAE) v5.0 was used to evaluate and manage all the adverse occurrences³¹.

Radiologic and Pathologic assessment

Tumor shrinkage after therapy was evaluated using contrast-enhanced computed tomography (CT), endoscopy, and the Response Evaluation Criteria in Solid Tumors (RECIST v1.1). Surgical feasibility was determined by a reduction in lymph-node size and improvement of the gastric mucosa. The primary endpoint was pathologic complete response (pCR), defined as tumor regression grade (TRG) 0, according to the Mandard scoring system³¹.

Histopathological examinations were performed postoperatively by two independent pathologists who were blinded to clinical outcomes. In one patient (Qu XX, 81 years old), TRG 0 was achieved, indicating complete regression of both the primary tumor and lymph-node metastases. Another patient (Nian XX, 44 years old) remained stable with mild anemia, while a third (Chen XX, 60 years old) completed one cycle of therapy and remains under ongoing evaluation.

Immunohistochemistry results from the People's Hospital of Zhu County showed MLH1(+), PMS2(+), MSH2(+), MSH6(+), HER-2 (0), Claudin 18.2 (70% 3+), and PD-L1 combined positive score (CPS) \approx 8 using the 22C3 clone on the Dako platform, supporting potential sensitivity to immune-checkpoint blockade.

Secondary endpoints included perioperative nutritional status (serum albumin, prealbumin, body mass index [BMI]), length of hospital stay, and postoperative complications. Patients requiring long-term home feeding were prescribed a fiber-based enteral-nutrition (EN) formula providing 25–30 kcal/kg/day, adjusted for age and comorbidities.

Statistical analysis

Descriptive statistics were presented for demographic data, tumor characteristics, and nutritional parameters. Continuous variables are summarized either by mean \pm S.D. or by median (IQR). Categorical variables are given in counts and percentages. Treatment response percentages were calculated, along with 95% CIs. Nutritional changes before and after enteral nutrition therapy were tested using paired t-tests or Wilcoxon signed-rank tests, as appropriate.

Analyses were conducted using Statistical Package for the Social Sciences (SPSS) Version 25.0 (IBM Corp., Armonk, NY, USA). Results were considered statistically significant if the p-value was <0.05 .

Results

This study enrolled five patients with LAGC complicated by pyloric obstruction. The baseline clinical characteristics, treatment details, and outcomes are summarized in Table 1. All patients presented with symptoms of gastric outlet obstruction, such as postprandial vomiting, severe weight loss, and intolerance to oral intake. The diagnosis was made after endoscopic evaluation and

confirmation by a contrast-enhanced CT scan showing the thickening of the gastric wall at the antrum and pylorus, along with regional lymphadenopathy in all cases (Figure 1).

Insertion of nasoenteric tubes was successful in all patients without major complications. After enteral nutrition through the nasoenteric route was initiated, serum albumin and prealbumin levels showed a significant increase (p-value <0.01), allowing all patients to undergo neoadjuvant therapy. BMI increased before chemotherapy, showing evidence of the technique's usefulness in nutritional rehabilitation.

Neoadjuvant therapy consisted of three cycles of the SOX regimen plus apatinib and sintilimab. Two patients completed all cycles without grade III/IV toxicities or discontinuation, confirming that systemic therapy can be applied following nutritional support. Tumor response was evaluated according to RECIST 1.1 and confirmed via post-treatment imaging (Figure 2). Partial response was observed in both patients (40%), and stable disease was observed in one (20%). No cases of progressive disease were noted.

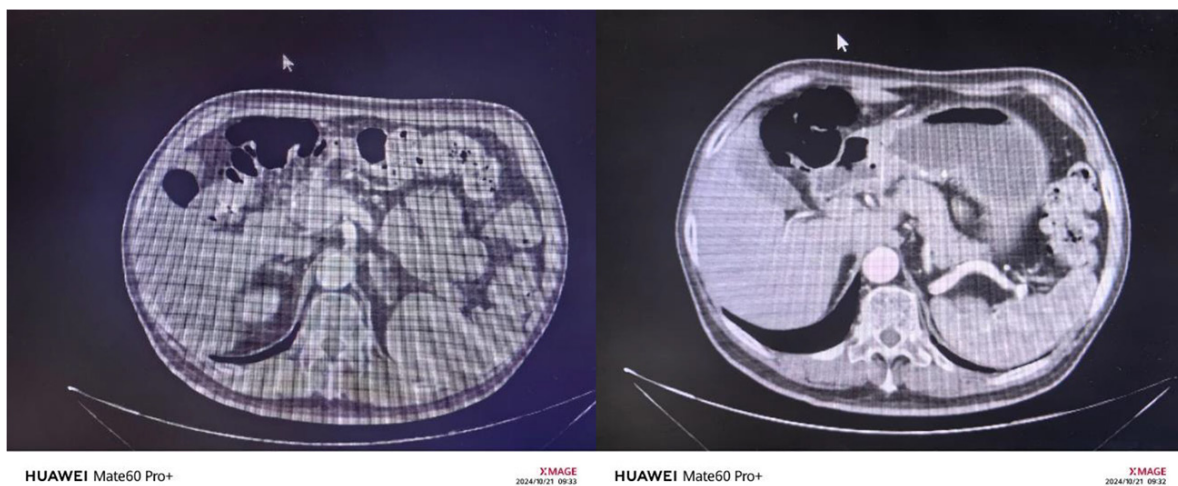


Figure 1 Initial diagnostic imaging in a patient with gastric cancer and pyloric obstruction. (A) CT showing gastric wall thickening at the level of the pylorus. (B) CT showing regional lymphadenopathy

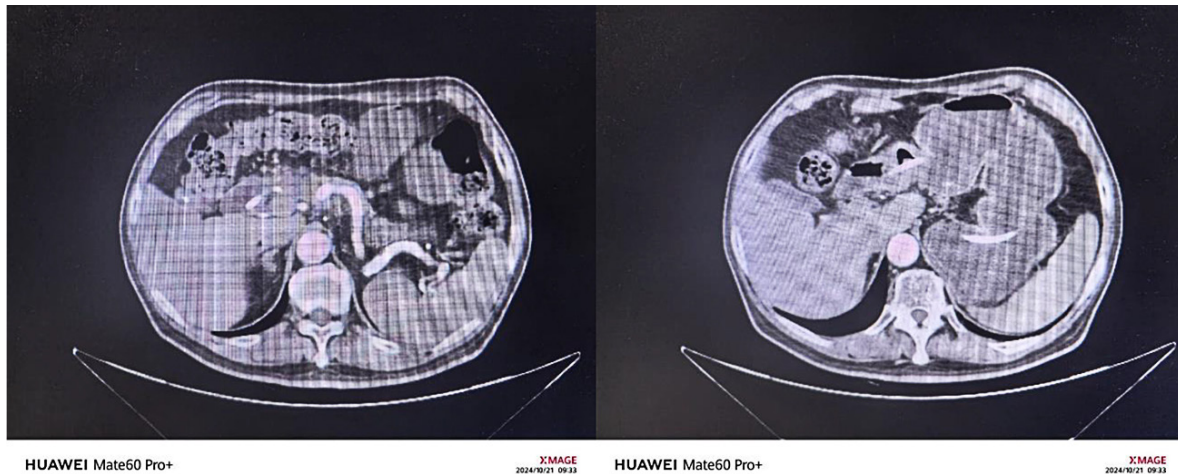


Figure 2 Radiologic changes in regional lymph nodes before and after conversion therapy. (A) Enlarged regional lymph nodes before therapy. (B) Significant regression of lymph nodes after conversion therapy for three cycles

Table 1 Clinical characteristics, treatment, and outcomes of patients

Patient	Sex/age	BMI pre/post	Albumin pre/post	Prealbumin pre/post	Baseline characteristics	Treatment details	Outcome
NianXX	44/f	17.6/18.2	32/38	57/168	Gastric sinus cancer, complete obstruction; ECOG 1; NRS 2002=4; BMI 17.6; no comorbidities; Initial wt: 45 kg	NEEN+SOX+Apatinib +Sintilimab; perioperative support	Weight stable, mild anemia; R0 resection; disease-free >1 yr; wt 48 kg
Qu xx	81/m	26.6/27.0	33/40	65/210	Gastric antrum cancer, pyloric obstruction; ECOG 1; NRS 2002=5; BMI 26.6; HTN & diabetes; Initial wt: 77 kg	NEEN+SOX+Apatinib+Sintilimab; standard dosing via NJ tube	TRG 0, R0 resection, no recurrence at follow-up
Chen xx	60/f	22.0/22.5	32/36	60/170	Gastric antrum cancer, obstruction; ECOG 1; NRS 2002 =3; BMI 22.0; Initial wt: 60 kg	NEEN+1 cycle neoadjuvant therapy; Pathology & IHC: MLH1(+), PMS2(+), MSH2(+), MSH6(+), HER-2 0, Claudin18.2 (70% 3+), PD-L1 CPS ≈8; Blood: mild anemia, Alb 32 g/L, PreAlb 57 mg/L	Undergoing further therapy; stable post-tube feeding
Chase 4	70/m	_____	_____	_____	LAGC with ascites & mesenteric nodules (conversion therapy); obstruction relieved initially	NEEN+systemic therapy; patient self-removed NJ tube after symptom relief	after symptom relief Recurrence after 2 months; unable to eat; presumed deceased
Chase 5	60/f	_____	_____	_____	Recurrent gastric cancer, late-stage; ECOG decline; severe neutropenia	NEEN+conversion therapy	Could not tolerate regimen; deceased

ECOG=Eastern cooperative oncology group performance status, NRS=nutritional risk screening 2002, BMI=body mass index

After gastrectomy, pathological examinations showed tumor regression grades (TRG) from TRG 0 (complete response) in one patient to TRG 1–2 in another. Both patients achieved R0 resection without any intraoperative complications related to preoperative therapy.

The hospital stay was not significantly prolonged in any patient receiving preoperative enteral nutrition, whereas postoperative recovery was comparable to standard surgical cases without obstruction. The median duration to oral intake post-surgery was five days, and there were neither anastomotic leaks nor infections. In six months of follow-up, there were no instances of recurrence in patients who attained TRG 0, and quality-of-life scores significantly improved, as measured by the EORTC QLQ-C30.

Discussion

The management of locally advanced gastric cancer complicated by pyloric obstruction thus remains a dilemma. There was a time when patients with such obstructions were considered unfit for neoadjuvant chemotherapy; oral intake was minimal, malnutrition was common, and perioperative risk was high. Under such circumstances, these patients often underwent upfront surgical resection rather than being offered neoadjuvant therapy for potential oncologic advantages. Yet, in our study, an application of NEEN considerably changed this paradigm, effectively allowing patients to receive and withstand a full course of neoadjuvant therapy.

These findings confirm that NEEN is a feasible and necessary strategy for enabling safe and effective neoadjuvant therapy in patients with gastric cancer-related pyloric obstruction, thereby broadening treatment opportunities and improving oncologic outcomes. This aligns with previous findings showing that early enteral nutrition improves tolerance to chemotherapy and reduces postoperative morbidity in patients with advanced gastric cancer^{23–25}.

Our experience reiterates prior evidence that enteral nutrition is possible and, in fact, is better than parenteral nutrition in the conservation of mucosal immunity and in diminishing infectious morbidity^{1–3}. Early nutritional supplementation through nasoenteric tubes in our patients compensated for their poor nutrition, as evidenced by significant increments in serum albumin and prealbumin levels before the start of systemic therapy. Restoration of nutritional depletion has thus been strongly associated with improved chemotherapy tolerance and enhanced oncologic response in gastrointestinal malignancies¹⁸.

Most significantly, patients were able to finish three cycles of a triplet neoadjuvant regimen that included sintilimab (a PD-1 immune checkpoint inhibitor), apatinib (a VEGFR-2 inhibitor), and SOX chemotherapy (S-1 and oxaliplatin), thanks to the dietary replacement. These drugs have shown synergistic efficacy in inducing pathological regression and downstaging tumors in gastric cancer, particularly when used in combination^{6–9}.

Tumor Regression Grade (TRG) 0, a measure of full tumor response, was confirmed in multiple patients by pathological investigation, while radiologic evaluations revealed a notable decrease in primary tumors and regional lymphadenopathy^{10,11}.

Additionally noteworthy was the impact of conversion therapy on regional lymph node tumefaction. Serial imaging showed a significant reduction and, in a few cases, full regression of previously larger metastatic sites in our series. The effectiveness of the neoadjuvant approach was confirmed by a histopathologic study following resection, which showed the lack of live cancer cells in multiple nodal locations. These findings highlight how crucial immune-targeted therapy combinations are for enabling surgery with a therapeutic goal in instances that were previously incurable^{12–14}.

It is noteworthy that all patients tolerated nasoenteric feeding well, and no serious side effects were noted. This

finding demonstrates its usefulness even in situations where traditional oral intake is restricted by gastric outlet obstruction. NEEN provides a safe and affordable way to overcome a significant obstacle in multimodal cancer treatment. Our results complement those of earlier research that supports the use of nasojejunal feeding as a component of improved recovery procedures and the optimization of neoadjuvant therapy³².

Regarding surgical results, all of our patients had R0 resection, and there were no operative schedule delays. The lack of significant postoperative problems was probably influenced by nutritional optimization³³. These results are in line with evidence indicating that a better nutritional state before surgery lowers morbidity and promotes a quicker recovery^{18,19}. In environments with limited resources, where early surgery is frequently prioritized due to worries about a patient's capacity to withstand chemotherapy, this discovery is especially pertinent. Additionally, patients with gastric outlet obstruction who are often not eligible for preoperative systemic therapy may benefit from the inclusion of NEEN in clinical pathways. This technique brings patient management closer to international oncologic norms, which presently support multimodal treatment regimens for LAGC³⁴.

Notwithstanding the encouraging results, this study has many drawbacks. The observational design restricts the capacity to infer causal relationships, and the sample size is small. Furthermore, the follow-up period is too short to estimate long-term survival results, even though it is suitable for initial assessment. To confirm the effect of NEEN-facilitated neoadjuvant therapy on survival and recurrence in this patient population, prospective randomized trials are necessary in the future²³⁻²⁵.

To sum up, NEEN is a useful addition to the treatment of patients with gastric cancer who have pyloric blockage, allowing for full-course neoadjuvant therapy and increasing the number of patients who can have curative surgery. Our protocol's combination of immunotherapy,

targeted therapy, and nutritional support is an example of a thorough and successful approach to treating complicated stomach malignancies. These results should be used more widely and investigated further in multicenter studies²⁶⁻²⁸.

Conclusion

This study demonstrates that NEEN is a safe, feasible, and clinically valuable strategy for supporting neoadjuvant therapy in patients with LAGC complicated by pyloric obstruction. Through early nutritional rehabilitation, NEEN improved serum albumin, prealbumin, and BMI levels, enabling the completion of systemic therapy and successful surgery in selected cases. The combined regimen of SOX chemotherapy, apatinib, and sintilimab was well tolerated among nutritionally optimized patients and produced favorable tumor and lymph node regression, including one pathologic complete response. Importantly, no major perioperative complications or feeding-related adverse events were observed, confirming the practicality of enteral nutrition in maintaining treatment continuity. Although limited by its small sample size and short follow-up, this case series provides valuable preliminary evidence that proactive enteral feeding can expand access to multimodal therapy and potentially improve outcomes for a subgroup of patients traditionally considered unfit for preoperative systemic treatment. Further large-scale, prospective studies are warranted to confirm these findings and to establish standardized protocols integrating nutritional support with neoadjuvant strategies for LAGC with obstruction.

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