

ANALYSIS OF APPLICATION VALUE OF 64-SLICE ENHANCED CT IN PREOPERATIVE N STAGING OF GASTRIC CANCER

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ABSTRACT

Objective: To study and compare the N-stage results of 64-slice enhanced CT and the postoperative pathological staging results of patients with gastric cancer before surgery, and to explore the diagnostic value of enhanced CT in preoperative N staging of gastric cancer.

Method: Preoperative enhanced CT and postoperative pathological results of 56 patients undergoing radical gastrectomy for gastric cancer in the gastrointestinal colorectal anus surgery from Huangshi Central Hospital, Affiliated Hospital of Hubei Polytechnic University from December 2016 to December 2017 were studied. Patient enrollment criteria: Patients with confirmed gastric cancer by gastroscopy and pathology, patients with complete CT examination and preoperative paraffin pathological results, and patients without neoadjuvant chemoradiation before surgery. All patients underwent radical gastrectomy within one week after CT examination, and it achieved complete resection of the margin (>4 cm). The lymph node dissection range is D2. All specimens in the operation were fixed by formalin in 30 minutes in vitro and delivered to the pathology department. Then, the staff of the pathology department made a slice and embedded it in paraffin, and continued the process of HE staining. Finally, the treated sections were diagnosed under the microscope by the pathologist. CT images of all cases were independently assessed by two radiologists with years of experience using D'Elia's gastric cancer lymph node assessment method. The pathological sections of all patients were independently observed by two senior pathologists and their respective N staging results were calculated. Based on the postoperative pathological results of the pathologist, the N-stage diagnosis of preoperative enhanced CT and the postoperative pathological N-stage diagnosis were compared. The consistency check was carried out using SPSS 22.0 software, which is the kappa test. Through comparison and statistical results, the accuracy of enhanced CT in preoperative N staging was explored.

Result: The overall accuracy of enhanced CT for preoperative N staging was 69.6% (39/56). In the 17 cases of N-stage misdiagnosis prior to enhanced CT surgery, ten cases were understage (58.8%), and seven cases were overstage (41.2%). The accuracy of enhanced CT diagnosis of N0 staging was 71.4% (10/14), and all 4 cases misdiagnosed were overstage (28.6%). The accuracy of the N1 staging was 72.7% (8/11). Two of the three cases of misdiagnosis were understage (18.1%). One case was overstage (9.2%). The accuracy of the N2 staging is 60.0% (9/15), Five cases are understage (33.3%) and one is overstage (6.7%). The accuracy of N3 staging was 75.0% (12/16), and 4 cases were understage (25.0%). The consistency test was performed with postoperative pathological diagnosis as the gold standard, and the kappa value was 0.603. For the N-stage assessment of gastric cancer, the CT findings and the postoperative pathological results are in good agreement.

Conclusion: The overall accuracy of enhanced CT examination for preoperative N staging was 69.6%, and the kappa test value was 0.603. The diagnosis results are in good agreement with the postoperative pathological diagnosis results. It has diagnostic value for the preoperative N-stage evaluation of gastric cancer and can be used for clinical guidance treatment.

Keywords: Enhanced CT, gastric cancer, N staging, consistency test.

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Introduction

Gastric mucosal epithelial cells cause malignant tumors in the stomach, which is a common malignant tumor. From the incidence rate, it is the main part of digestive system malignant tumor. At present, malignant tumors in China and Japan are the most serious. 95% of gastric malignancies are adenomas. Most patients with gastric cancer have

entered the stage of development at the time of diagnosis, and the diagnosis rate of precancerous gastric cancer is below 10%. Many patients with advanced gastric cancer have lost the best time to perform surgery. In addition, even if the patient with early gastric cancer is undergoing surgery, there is still a great possibility of metastasis and recurrence⁽¹⁾. At present, there are many ways to treat gastric cancer, including chemotherapy, radi-

otherapy, and Chinese medicine treatment. Among them, the best and most direct is the quality of surgery. The range and extent of lymph node cleanup is important. This has a far-reaching impact on the prognosis of patients⁽²⁾.

As a common source of epithelial tumors, the incidence of gastric cancer is high in the world. China's gastric cancer patients account for more than half of the world's cancer patients, and their health and life are suffering. The annual incidence rate of gastric cancer is about 400,000, which is more than 40% of the global scale, and its mortality rate is increasing year by year⁽³⁾. Gastric cancer is divided into advanced gastric cancer and early gastric cancer. All lesion depths below the submucosa are defined as advanced gastric cancer. The incidence of gastric cancer in young people is not high compared to other age groups. Middle-aged and elderly people aged 50-70 have a higher incidence of gastric cancer, and the proportion of male patients is very large⁽⁴⁾. The main area of the lesion is in the antrum of the stomach. In addition, lesions are also found in the stomach, cardia and other parts. With the economic and social development, many young people suffer from stomach cancer, and the trend is becoming obvious⁽⁵⁾.

The key factors causing the emergence of gastric cancer and its pathogenesis have not yet been conclusive. Some scholars continue to conduct in-depth research on it. Most of the conclusions focus on the following aspects: genetic factors, regional factors, lifestyle and infectious factors⁽⁶⁾. The lesion will gradually lead to the following conditions: First, upper gastrointestinal symptoms: there is a painful condition in the upper abdomen. After a meal, satiety is easy to occur. Secondly, when the tumor invades the blood vessels, the gastrointestinal tract is bleeding. If the amount of bleeding is large and the speed is high, the patient will have vomiting symptoms⁽⁷⁾. If the bleeding rate is slow and the amount is insufficient, the patient will have a black stool⁽⁸⁾. The symptoms associated with the tumor are also different. When the tumor in the pyloric area causes the overall obstruction of the pyloric region to eventually cause vomiting and other symptoms, most of the vomit is gastric juice and food⁽⁹⁾. High curvature of the lateral side of the cancer will lead to choking. Finally, when the tumor enters the late stage, metastasis eventually leads to systemic symptoms. Among them, significant symptoms include anemia, jaundice, weight loss, fatigue, ascites, cachexia, and bloating⁽¹⁰⁾.

At present, the research on preoperative lymph node metastasis of gastric cancer has received attention from researchers from all walks of life. The extent and degree of lymph node metastasis helps patients to choose scientific and effective surgical methods. It also has profound effects on the prognosis of patients. With the advancement of science and technology, most imaging examination methods can more accurately evaluate the preoperative lymph node metastasis⁽¹¹⁾. In clinical examinations, CT is the most commonly used method of examination because of its outstanding accuracy and recommended form of operation, and it is most significantly advanced by technological development. CT enhancement technology improves the accuracy of N-stage diagnosis, and vascular enhancement can be used to perform metastases that are unclear in CT plain scans⁽¹²⁾. The innovation of this study was to perform an enhanced CT examination on the patient before surgery and to evaluate the N stage. The postoperative pathological N staging was compared with the evaluation results, and the accuracy of enhanced CT for N staging evaluation was obtained, to confirm the value of enhanced CT in preoperative judgment of lymph node metastasis.

Materials and methods

Research object

Preoperative enhanced CT and postoperative pathological results of 56 patients undergoing radical gastrectomy for gastric cancer in the gastrointestinal colorectal anus surgery from Huangshi Central Hospital, Affiliated Hospital of Hubei Polytechnic University from December 2016 to December 2017 were studied. The patient's age ranged from 29 to 77 years, and the average age is 63.4 years. All patients (or their families) signed an informed consent and this study was approved by the Ethics Committee of Huangshi Central Hospital, Affiliated Hospital of Hubei Polytechnic University.

Patient enrollment criteria: Patients with confirmed gastric cancer by gastroscopy and pathology, patients with complete CT examination and preoperative paraffin pathological results, and patients without neoadjuvant chemoradiation before surgery.

Exclusion criteria: all patients who underwent neoadjuvant chemoradiotherapy before surgery, patients who were unable to undergo radical resection due to excessive tumor volume, patients with abdominal surgery, patients with residual gastric cancer, and patients with incomplete imaging data.

Among them, male patients were 45 cases, accounting for 80.4%. The age ranged from 29 to 77 years, and the average age is 62.8 years. Female patients were 11 cases, accounting for 19.6%. The age ranged from 42 to 76 years, and the average age is 63.4 years. The total number of patients with the original disease in the gastric antrum area was 26. One patient diseased in the cardia. One patient diseased in the cardia of stomach and the gastric fundus. Twelve patients diseased in the gastric antrum area. Five patients diseased in the tumor invading the whole stomach. Ten patients diseased in the stomach area.

Research methods

Preparation before inspection: The patient cannot eat or drink for 6-8 hours. Half an hour before the examination, the patient drank 1000 ml water. Ten minutes before the test, the patient was injected with 20 mg of anisodamine (654-2) (Jinan Haohua Industrial Co., Ltd., Jinan, China) to help limit gastrointestinal motility and obtain a good observation. The doctor assisted the patient in breathing training.

The patient was placed in a supine position. 64-slice CT (US General Motors, Boston, USA) is used for scanning. After completion, the iopromide solution (Bayer HealthCare, Leverkusen, Germany) was intravenously injected 80 ml before the elbow. Injection of contrast agent 20-30s is the arterial phase, 60-70s is the venous phase, and the delay period is specifically 120-180s. More than two experienced radiologists evaluate the test results. If there are differences, doctors can objectively discuss the final conclusions.

Method and treatment

When the surgeon completes the laparotomy, the ascites condition is observed, and once the ascites is found, the color and stock are recorded. Through the principle of no tumor, the abdominal internal organs are examined with great care, in the order of pelvic, axillary, liver, and mesenteric roots. Finally, the location, size and actual condition of the primary tumor were observed, and the preoperative target was supplemented with a clear effect, thereby further defining the extent of gastric resection and the degree of lymph node dissection. Through actual investigation, 23 patients underwent radical total gastrectomy in 56 patients. A total of 33 patients underwent radical distal gastrectomy (type II). Intraoperative partial resection

of the margin was negative ($> 4\text{cm}$). D2 resection is the main part of the lymph node dissection range, and the specific number is more than 16.

The lymph node dissection range is D2. All specimens in the operation were fixed by formalin (Shandong Bai Qian Chemical Industry Co., Ltd., Shandong, China) in 30 minutes in vitro and delivered to the pathology department. Then, the staff of the pathology department made a slice and embedded it in paraffin, and continued the process of HE staining. Finally, the processed sections were observed under a microscope. At least two experienced pathologists evaluate separately and give the final diagnosis.

Diagnostic criteria

D'Elia lymph node metastasis staging criteria commonly used in China: short-stomach lymph nodes $>6\text{ mm}$ and short-diameter lymph nodes $>8\text{ mm}$ outside the stomach indicate lymph node metastasis. In addition, if the length to diameter ratio of the lymph nodes is above 0.7, regardless of the short diameter of the lymph nodes, the lymph nodes are treated with metastasis. CT staging is carried out through the actual grouping of gastric cancer.

Through the US Cancer Joint Commission and the International Anti-Cancer Alliance, the seventh edition of the TNM staging method was established to define the staging criteria for lymph node metastasis of gastric cancer: N0 is not lymph node metastasis. N1 is a metastasis of 1-2 lymph nodes in regional lymph nodes. N2 is a metastatic condition in 3-6 regional lymph nodes. In the N3a phase, 7-15 regional lymph nodes have metastasis. In the N3b phase, more than 15 regional lymph nodes have metastatic status. Nx is an abnormal assessment of lymph node metastasis. The pathologist performed pathological diagnosis analysis by removing the number of lymph nodes metastasized from the lesion.

Statistical methods

The postoperative pathological diagnosis was set as the normative standard, so that patients can enhance the N-stage diagnosis results of CT and the effective comparison of postoperative pathology. The consistency check is performed by SPSS 22.0 software, which is the kappa test. If the kappa value is above 0.7, the consistency of the test results is good. If the kappa value ranges from 0.4 to 0.7, the consistency of the test results is normal. If the kappa value is less than 0.4, the consistency of the test results is poor.

Results

The accuracy of enhanced CT in preoperative N staging

The overall accuracy of enhanced CT for preoperative N staging was 69.6% (39/56). The sensitivities of N0, N1, N2 and N3 were 71.4%, 72.7%, 60.0% and 75.0%, respectively. In the 17 cases of N-stage misdiagnosis prior to enhanced CT surgery, ten cases were understage (58.8%), and seven cases were overstage (41.2%). The accuracy of enhanced CT diagnosis of N0 staging was 71.4% (10/14), and all 4 cases misdiagnosed were overstage (28.6%). The accuracy of the N1 staging was 72.7% (8/11). Two of the three cases of misdiagnosis were understage (18.1%). One case was overstage (9.2%). The accuracy of the N2 staging is 60.0% (9/15), Five cases are understage (33.3%) and one is overstage (6.7%). The accuracy of N3 staging was 75.0% (12/16), and 4 cases were understage (25.0%). Table 1 is a comparison between preoperative enhanced CT staging and postoperative pathological N staging. Figure 1 is the accuracy of enhanced CT diagnosis at different stages.

Pathological staging	Number of cases	CT staging (cases)				Total accuracy
		N0	N1	N2	N3	
N0	14	10	4	0	0	71.4%
N1	11	2	8	1	0	72.7%
N2	15	2	3	9	1	60.0%
N3	16	0	2	2	12	75.0%
Total	56	14	17	12	13	69.6%

Table 1: Comparison between preoperative enhanced CT staging and postoperative pathological N staging.

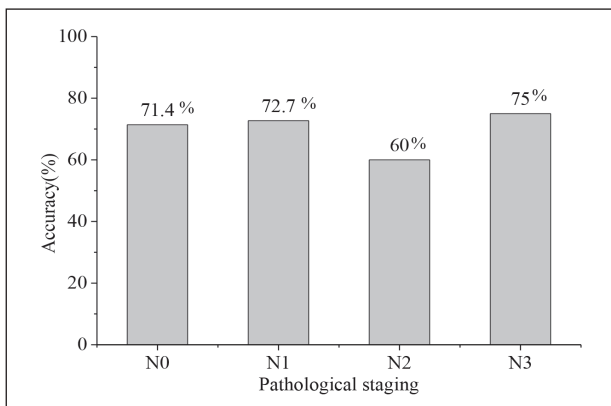


Fig 1: Accuracy of enhanced CT diagnosis at different stages.

Consistency test

Postoperative pathological diagnosis was used as the gold standard, and SPSS 22.0 software was used for consistency test (i.e., kappa test),

kappa value=0.603. For the N-stage evaluation of gastric cancer, the CT findings and the postoperative pathological results are in good agreement, as shown in Table 2, Table 3 and Figure 1. Figure 2 shows the number of cases of postoperative pathological N0, N1, N2, and N3 stages.

Pathological staging	Number of cases	CT staging (cases)				P value	Kappa value	Total accuracy
		N0	N1	N2	N3			
N0	14	10	4	0	0	0.000	0.603	69.6%
N1	11	2	8	1	0			
N2	15	2	3	9	1			
N3	16	0	2	2	12			
Total	56	14	17	12	13			

Table 2: Accuracy of enhanced CT diagnosis at different stages.

	Sensitivity	Specificity	Negative predictive value	Positive predictive value
N0	71.4%	0.909	0.909	71.4%
N1	72.7%	0.810	0.919	50.0%
N2	60.0%	0.923	0.878	75.5%
N3	75.0%	0.974	0.902	92.3%

Table 3: Specificity and sensitivity of NO-N3 diagnosis.

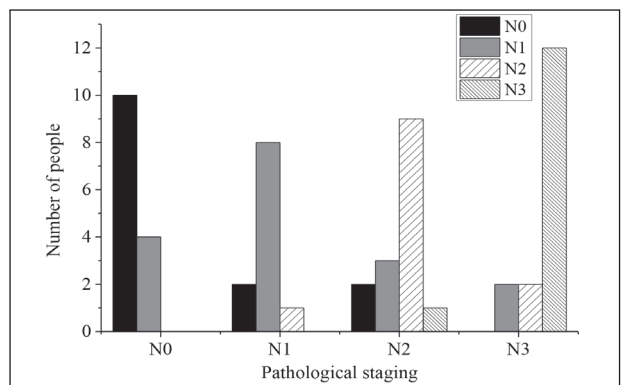


Fig 2: The number of cases of postoperative pathological N0, N1, N2, and N3 stages.

Discussion

The overall accuracy of enhanced CT for preoperative N staging was 69.6% (39/56). The sensitivities of N0, N1, N2, and N3 were 71.4%,

72.7%, 60.0%, and 75.0%, respectively. In the 17 cases with enhanced preoperative N-stage misdiagnosis, 10 cases were under-staged (58.8%) and 7 cases were over-staged (41.2%). The accuracy of enhanced CT diagnosis of N0 staging was 71.4% (10/14), and all 4 cases misdiagnosed were over-dose (28.6%). The accuracy of the N1 staging is 72.7% (8/11). In the 3 cases misdiagnosed, 2 cases were under-staged (18.1%) and 1 case was over-staged (9.2%). The accuracy of the N2 staging was 60.0% (9/15). 5 cases were under-staged (33.3%) and 1 case was over-staged (6.7%). The accuracy of N3 staging was 75.0% (12/16). 4 cases were under-staged (25.0%). Consistency test was performed with postoperative pathological diagnosis as the gold standard, kappa value = 0.603. For the N-stage assessment of gastric cancer, the CT findings and the postoperative pathological results are in good agreement.

In summary, the overall accuracy of the enhanced CT examination for preoperative N staging was 69.6%, and the kappa value was 0.603. The diagnosis results are in good agreement with the postoperative pathological diagnosis results. It has diagnostic value for the preoperative N-stage evaluation of gastric cancer and can be used for clinical guidance treatment.

There are many limitations in enhancing the count of peritumoral metastatic lymph nodes in CT images. For example, lymph nodes are aggregated and fused, and the perihepatic adipose tissue is less. The lymph nodes adjacent to the tumor and the primary tumor are difficult to identify, which will affect the counting of lymph nodes and lead to insufficient staging. In this study, the N stage of CT imaging first determines the metastatic lymph nodes based on the size, shape and degree of enhancement of the lymph nodes. Then, the N-stage results in imaging were determined according to the location of the lymph nodes, which was not related to the number of metastatic lymph nodes in the image. This is the advantage of this study. The difference in diagnostic staging criteria between imaging and postoperative pathology also affects the accuracy of CT in preoperative N staging to some extent. For decades, there has been a special case of lymph node metastasis in gastric cancer, namely the leaching metastasis of lymph nodes. In some cases, the lymph node metastasis was not transferred in the order from the first station to the third station, but directly in the second station or the third station.

The lymph node in the first station near the primary lesion was a negative lymph node. The presence of skip metastatic lymph nodes can lead to over-staged imaging of preoperative N-stage diagnostic results compared with postoperative pathological findings.

There are still some shortcomings in this study. Because this study is a retrospective study, it is not possible to determine whether the diagnostic results of the lymph nodes considered for metastasis in the enhanced CT image are consistent in the actual resected specimen. In the future study, prospective studies should be performed to locate and clean the lymph nodes that were considered positive in preoperative imaging. The postoperative group was sent for examination to determine whether the positive lymph nodes considered before surgery were metastatic lymph nodes.

The overall accuracy of the enhanced CT assessment of preoperative lymph node metastasis in this study was 69.6%. The accuracy of preoperative evaluation of N0 was 71.4% (10/14), the accuracy of N1 was 72.7% (8/11), the accuracy of N2 was 60.0% (9/15), and the accuracy of N3 was 75.0% (12/16). The scholar Tsurumaru believes that the detection rate of lymph nodes around the common hepatic artery and hepatoduodenal ligament is low. The detection rate of lymph nodes around the mesenteric and abdominal aorta was the highest, followed by the small curved lymph nodes. The higher the tumor stage, the easier the lymph node is to fuse, and the higher the degree of enhancement, the more easily the fusion is seen in the CT image with the enhanced lymph nodes⁽¹⁵⁾. This is also consistent with the highest accuracy in N3 staging and the lowest N2 staging accuracy in this study.

One of the most important criteria for determining whether a lymph node is a metastatic lymph node in the staging of CT is the size and degree of enhancement of the lymph node. There are many causes of lymph node enlargement in the human body, including inflammatory infiltration and reactive hyperplasia in addition to tumor metastasis. In the tumor inflammatory hypothesis proposed by Park HS, it is mentioned that the higher the tumor stage, the more likely it is to promote inflammation. The normal lymph nodes located in different regions also have their own differences in size, such as 6 mm after the lymph nodes and 8 mm next to the cardia. All these factors can lead to over staging of CT. The detection rate of lymph nodes varies in different regions.

The reason is related to the amount of adipose tissue around the lymph nodes. When the content of adipose tissue is small, the detection rate of lymph nodes is low. For example, a small amount of adipose tissue in the area where the gastric lymph nodes are located leads to a relatively low detection rate. At the same time, if the lymph node itself contains more adipose tissue, the density difference between the lymph node and the surrounding adipose tissue is smaller in the CT image. In addition, there is also the effect of respiratory artifacts during the patient's breathing movement in the examination, which may cause difficulty in identification in the image. Studies by scholars such as Yoshida have shown that in all metastatic lymph nodes of gastric cancer, about 55% of metastatic lymph nodes are no larger than 5 mm in size and are not associated with enhancement. That is to say, at least half of the lymph nodes are unable to determine whether they are metastatic lymph nodes by judging their size⁽¹⁶⁾. All these factors can cause insufficient staging of CT.

In this study, patients with gastric cancer who underwent radical gastrectomy for gastrointestinal colorectal anus surgery were selected as subjects. An enhanced CT examination was performed before surgery and the N stage was evaluated. The results of the evaluation were compared with the postoperative pathological N staging results. The accuracy of the enhanced N-stage assessment was analyzed to confirm the value of CT in preoperative judgment of lymph node metastasis. The advantages of enhanced CT are rapid scanning speed, high resolution in time and space, and convenient image reconstruction, which can be used to estimate lymph node metastasis and direct clinical staging through thin-layer scanning and reconstruction techniques. For some lesions with no obvious features in CT scan, the contrast can be increased after injection of contrast agent to further confirm the diagnosis. On this basis, enhanced CT has high accuracy in tumor infiltration and preoperative evaluation of distant metastasis. At present, CT has been one of the preferred imaging examinations for preoperative evaluation of gastric cancer.

In this study, the number of cases is relatively small, and there are certain restrictions on statistics and comparison. In future research, the number of cases should be expanded. Different researchers have different criteria for determining metastatic lymph nodes in CT images. Different standards lead to some differences in the results. In

this study, only D'lia lymph node metastasis staging criteria were used. In the future research, multiple standards should be used for comprehensive comparison to obtain scientific research results.

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