

APPLICATION VALUE OF CT AND DOUBLE CONTRAST-ENHANCED ULTRASOUND IN TNM STAGING OF GASTRIC CANCER PATIENTS BEFORE OPERATION

XIN LI[#], HUABO LIANG[#], QIONG LUO, JUN WANG^{*}

Department of Radiology, Jingmen People's Hospital NO.2, Jingmen, Hubei, 44800, China

[#]These authors contributed equally to this work**ABSTRACT**

According to the TNM staging of gastric cancer patients before operation, CT and dual contrast-enhanced ultrasound were used to diagnose the tumors, and the diagnostic value was analyzed to provide the corresponding reference for clinical practice. The clinical data of 100 patients with gastric cancer admitted to Jingmen Second People's Hospital from January 2017 to December 2018 were retrospectively analyzed. All patients were confirmed by endoscopy and pathology. Three days before the operation, all patients were examined by CT and double contrast-enhanced ultrasound, and were staged according to the examination. Patients' satisfaction with the two methods of examination was compared and analyzed. The results were compared with the results of pathological TNM staging after the operation. Statistical analysis was carried out. Before CT examination, the accuracy rate of judging T1, T2, T3, T4 and T stages was 62.07%, 65.71%, 65.38%, 30.00% and 61.00%, respectively. The preoperative accuracy of double contrast-enhanced ultrasonography was 79.31%, 85.71%, 80.77%, 70.00% and 81.00% for T1, T2, T3, T4 and T stages respectively. By comparing the two diagnostic methods, double contrast-enhanced ultrasound was higher than CT, and the difference was statistically significant ($P < 0.05$). Postoperative pathology confirmed that 47 cases had no lymph node metastasis (N0), 53 cases had lymph node metastasis (N+). Preoperative CT examination showed that the accuracy of N0 phase was 74.47%, N+ phase was 75.47%, and total N phase was 75.00%. Preoperative double contrast-enhanced ultrasonography showed that the accuracy of N0 phase was 78.72%, N+ phase was 81.13%, and total N phase was 80.00%. Compared with the two diagnostic methods, double contrast-enhanced ultrasonography was higher than CT, but there was no significant difference ($P > 0.05$). Postoperative pathology confirmed 61 patients in M0 stage and 39 patients in M1 stage. Preoperative CT examination showed that the accuracy of M0, M1 and M stages was 93.44%, 84.62% and 90.00%, respectively. The accuracy of preoperative double contrast-enhanced ultrasonography was 95.08% for M0, 89.74% for M1 and 93.00% for M. Compared with the two diagnostic methods, double contrast-enhanced ultrasound was higher than CT, but there was no significant difference ($P > 0.05$). The total satisfaction rate of double contrast-enhanced ultrasound patients was 94.00% (94/100), and that of CT patients was 91.00% (91/100), with no significant difference ($P > 0.05$). In the diagnosis of TNM staging of gastric cancer patients before operation, the accuracy of T staging before double contrast-enhanced ultrasound is higher than that of CT and the accuracy of N and M staging is higher and similar. Overall, the diagnostic effect of double contrast-enhanced ultrasound is better than that of CT, but it is suggested that clinical preoperative examination should be combined to improve the accuracy of preoperative TNM staging diagnosis, so as to provide more valuable reference for the formulation of treatment plan.

Keywords: CT, contrast-enhanced ultrasound, gastric cancer, TNM staging, diagnosis.

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Introduction

Gastric cancer is one of the most common malignant tumors of digestive tract with high incidence. Survey data show that among malignant tumors in China, the incidence of gastric cancer is second only to lung cancer, ranking second in all malignant tumors. For the treatment of gastric cancer, early diagnosis and staging are very important. Scientific and

reasonable diagnosis and staging are of great significance for the treatment and prognosis of the disease. Studies have shown that most patients with gastric cancer generally go to relevant medical institutions for examination after symptoms occur, but the rate of early consultation is relatively low. Some patients delay the examination because of fear of gastroscopy, thus affecting the follow-up treatment of the disease. Early X-ray and gastroscopy diagnosis has

different limitations. For example, only mucosal lesions can be seen, but the invasive depth of lesions and the involvement of adjacent organs cannot be accurately estimated. As a result, the accuracy of TNM staging before clinical operation is greatly affected. In recent years, besides X-ray and gastroscopy, CT, MRI and dual contrast-enhanced ultrasonography have been widely used, which has greatly promoted the development and progress of preoperative diagnosis of gastric cancer. Especially in the diagnosis of TNM staging before operation of early gastric cancer by CT and double contrast-enhanced ultrasound, there is a high diagnostic value, and the difference between them has a high research value. In this paper, 100 patients with gastric cancer diagnosed in Jingmen Second People's Hospital were included in the study. In the preoperative TNM staging diagnosis, CT and dual contrast-enhanced ultrasonography were performed respectively, and satisfactory results were achieved. The report is as follows.

Materials and methods

General information

The clinical data of 100 patients with gastric cancer confirmed by endoscopy and pathology in Jingmen Second People's Hospital from January 2017 to December 2018 were collected and analyzed retrospectively. Of all the patients, 58 were male (58.00%) and 42 were female (42.00%). The age ranged from 36 to 78 years, with an average age of (62.31 ± 2.57) years, and the course of disease ranged from 2 to 8 years, with an average duration of (4.21 ± 1.53) years. The locations of the tumors confirmed by endoscopy were: 16 cases of gastric fundus (16.00%), 24 cases of gastric lesser curvature (24.00%), 11 cases of gastric greater curvature (11.00%), 35 cases of gastric antrum (35.00%), 10 cases of most diffuse infiltration of the stomach (10.00%) and 4 cases (4.00%). Histological differentiation degree of pathological diagnosis after operation: 13 cases were highly differentiated (13.00%), 21 cases were moderately differentiated (21.00%) and 66 cases were poorly differentiated (66.00%). In terms of surgical treatment, total gastrectomy was performed in 38 cases (38.00%), distal subtotal gastrectomy in 42 cases (42.00%) and proximal radical gastrectomy in 10 cases (10.00%).

Method

All patients underwent CT and dual contrast-enhanced ultrasound three days before operation. Diagnostic examination required patients to fasting for 8

hours. 20 minutes before examination, patients were advised to drink 1000 ml of water, another 25% mannitol 500 ml and anisodamine 20 mg intravenously. The specific operations of CT and dual contrast-enhanced ultrasound are as follows:

CT diagnosis and inspection operation:

- Instruments and equipment: the equipment used is GE Light Speed VCT 64 row volume CT;
- Parameter setting: scanning parameters are 5 mm thickness, 1.0 pitch, 1.0 mm reconstruction thickness, 120 kV tube voltage and 150 mA tube current;
- Guiding patients to take supine position, hold their breath once, complete the scan, and scan the iliac spine line level from the diaphragm. After routine plain scan, dynamic dual-phase enhanced scan was performed. High-pressure syringe was used to inject non-ionic contrast agent iopramine 100ML through anterior elbow vein. The injection rate was 30 seconds after injection of contrast agent, arterial phase was scanned, and portal phase was scanned at 60 seconds;
- After volume scanning, the post-processing image is transmitted to the workstation for plane reconstruction, three-dimensional volume reconstruction and other post-processing.

Dual contrast-enhanced ultrasonography

First, the patients were examined by conventional two-dimensional ultrasonography to find out the details of the organs, pelvic and abdominal lymph nodes of the patients in the state of fasting. Patients were advised to take orally the gastric window contrast solution at doses ranging from 500 to 800 ml. In the observation of taking, close observation of patients should be maintained.

If the lesion of gastric cancer is located in the cardia, the patient should be instructed to remain supine; if the lesion of gastric cancer is located in the fundus, body or antrum of stomach, the patient should be assisted to adjust the position to the right side. When the image is unsatisfactory, the body position can be adjusted appropriately to obtain the most satisfactory imaging effect.

After determining the location of the lesion, the size and depth of the lesion were measured, and the lesion was enlarged locally. The image was automatically optimized. The routine recommendation of group radiography through anterior elbow vein was 2.4 ml, and then 10 ml of saline was injected. Its purpose is to fully promote the entry of contrast agents

into the blood, thereby promoting blood circulation and storing dynamic images in accordance with the scheduled.

Staging standard

Referring to the latest TNM staging criteria issued by the Joint American Cancer Commission (AJCC) and the International Anti-Cancer Alliance (UICC):

- T staging: tumor immersion in the mucosa or submucosa represents T1; tumor immersion in the muscular or submucosa represents T2; Tumor penetrates plasma, but does not invade adjacent organs, indicating T3. Tumors penetrate the serosa and invade adjacent organs, indicating T4. N0: No regional lymph nodes were involved (no tumors were found in the lymph nodes);

- N stage: No regional lymph node involvement (lymph node no tumor was found) denotes N0. Lymph node involvement represents N+. (regional lymph node cannot be assessed, it means NX; only a few nearby lymph nodes are involved, it means N1; between N1 and N3, it means N2; distant or more lymph nodes are involved, it means N3).

- M stage: No distant metastasis of the tumors, or no dissemination of the tumors to other parts of the body, indicates M0; distant metastasis of the tumors, or dissemination of the tumors to other parts of the body, indicates M1;

- Satisfaction of patients with various diagnostic methods was investigated, and self-made questionnaire of patients' satisfaction was used. The total score is 0-100, the score (>90) is very satisfactory, the score 70-89 is satisfactory, and the score (<70) is unsatisfactory. Total satisfaction is the sum of satisfaction and very satisfaction.

Statistical processing

SPSS21.0 statistical software package was used for data analysis. Measurement data are expressed in ($\bar{x} \pm s$). t-test was used for comparison between groups. Counting data are expressed in% form. χ^2 test was used for comparison between groups. $P < 0.05$ was statistically significant.

Results

Basic situation of TNM staging confirmed by pathology after operation in all patients with gastric cancer

100 cases of gastric cancer were confirmed by endoscopy and pathology after operation. In T stage,

29 cases were in T1 stage, 35 cases in T2 stage, 26 cases in T3 stage and 10 cases in T4 stage. The proportion of each stage was 29.00%, 35.00%, 26.00% and 10.00%, respectively. In N stage, 47 cases were in N0 stage and 53 cases were in N + stage, with 47.00% and 53.00% respectively. In M stage, 61 cases were in M0 stage and 39 cases in M1 stage, with 69.00% and 31.00% respectively. As shown in Table 1.

T stage				N stage		M stage	
T1 stage	T2 stage	T3 stage	T4 stage	N0	N+	M0	M1
29	35	26	10	47	53	61	39

Table 1: Basic information of TNM staging confirmed by pathology after operation in all patients with gastric cancer.

Comparison of diagnostic accuracy of preoperative T-staging between CT and double contrast-enhanced ultrasound

The accuracy rate of T1, T2, T3 and T4 staging before double contrast-enhanced ultrasound was higher than that before CT, and the total accuracy rate was higher than that before CT, the difference was significant ($P < 0.05$). As shown in Table 2.

Diagnostic examination	T1 (n=29)	T2 (n=35)	T3 (n=26)	T4 (n=10)	Total accuracy (n=100)
CT diagnosis	18 (62.07)	23 (65.71)	17 (65.38)	3 (30.00)	61 (61.00)
Dual contrast-enhanced ultrasound	23 (79.31)	30 (85.71)	21 (80.77)	7 (70.00)	81 (81.00)
χ^2	-	-	-	-	9.714
P	-	-	-	-	0.002

Table 2: Comparisons of diagnostic accuracy of preoperative T-staging between CT and double contrast-enhanced ultrasound [n (%)].

Accuracy comparison of preoperative N-staging diagnosis by CT and double contrast-enhanced ultrasound

The diagnostic accuracy of N0 phase, N + phase and total N phase before double contrast-enhanced ultrasound was higher than that of CT, but there was no significant difference ($P > 0.05$). As shown in Table 3.

Diagnostic examination	N0 stage (n=47)	N+ stage (n=53)	N total stage (n=100)
CT diagnosis	35 (74.47)	40 (75.47)	75 (75.00)
Dual contrast-enhanced ultrasound	37 (78.72)	43 (81.13)	80 (80.00)
χ^2	-	-	0.717
P	-	-	0.397

Table 3: Comparison of diagnostic accuracy of preoperative N and M staging between CT and double contrast-enhanced ultrasound [n (%)].

Comparisons of diagnostic accuracy of pre-operative M-staging between CT and double contrast-enhanced ultrasound

The diagnostic accuracy of M0, M1 and M phases before double contrast-enhanced ultrasound was higher than that of CT, but there was no significant difference ($P>0.05$). As shown in Table 4.

Diagnostic examination	M0 stage (n=61)	M1 stage (n=39)	M total stage (n=100)
CT diagnosis	57 (93.44)	32 (80.05)	90 (90.00)
Dual contrast-enhanced ultrasound	58 (95.08)	35 (89.74)	93 (93.00)
χ^2	-	-	0.578
P	-	-	0.447

Table 4: Comparisons of diagnostic accuracy of preoperative M-staging between CT and double contrast-enhanced ultrasound [n (%)].

Comparisons of satisfaction of patients with two diagnostic examinations

The total satisfaction of patients with double contrast-enhanced ultrasound diagnosis was higher than that of CT diagnosis, but there was no significant difference ($P>0.05$). As shown in Table 5.

Diagnostic examination	Dissatisfied	Satisfied	Very satisfied	Total satisfaction
CT diagnosis	9	41	50	91 (91.00)
Dual contrast-enhanced ultrasound	6	39	55	94 (94.00)
χ^2	-	-	-	0.649
P	-	-	-	0.421

Table 5: Comparisons of patients' satisfaction with two diagnostic examinations [n (%)].

CT Diagnostic imaging of a gastric cancer case

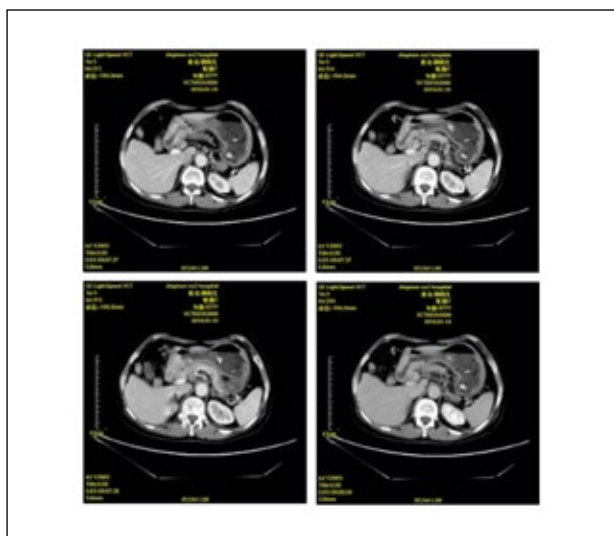


Figure 1: ????????????????

Discussion

Among clinical malignant tumors, gastric cancer is a common and frequently occurring disease, which originates from gastric mucosal epithelium. In the incidence of malignant tumors of digestive tract, this malignant tumor ranks first. Gastric cancer is predominant in the middle-aged and elderly population. The incidence of gastric cancer is higher in males than in females. The proportion between them is about 2:1. The incidence of gastric cancer is related to living environment, dietary pattern, Helicobacter pylori infection, heredity and gene factors. Influenced by changes in lifestyle and eating habits, the incidence of gastric cancer has increased significantly in recent years, and shows a certain younger trend. After the onset of gastric cancer, there are different symptoms in different stages: There were no obvious symptoms in the early stage, and some patients had gastrointestinal reactions such as nausea and vomiting. Cancer pain is more common in advanced patients, who are thin and lose weight. In the late stage, anemia, emaciation, malnutrition and even cachexia often occur. According to reports, more than 80% of gastric cancer patients have entered the middle and advanced stage after detection, with poor prognosis and high mortality. Therefore, early diagnosis, examination and staging are very important. Scientific and reasonable early diagnosis can effectively improve the survival rate of patients with gastric cancer.

Clinically, there are many methods to diagnose gastric cancer, such as gastroscopy, endoscopy, X-ray barium meal radiography and so on. All these methods can be used in the diagnosis of TNM staging of gastric cancer before operation. They have good results, but they also have some limitations. Taking gastroscopy as the preferred examination method for gastric cancer, only the surface of gastric mucosa can be observed, the whole layer of gastric wall cannot be fully displayed, the judgment of the depth of invasion of gastric cancer is limited, and the invasion and metastasis of adjacent organs cannot be understood, so sometimes the desired results cannot be achieved. With the continuous development of imaging technology, multi-slice spiral CT has been widely used in clinic, which greatly improves the accuracy of TNM staging and the detection rate of small lesions in gastric cancer. The GE Light Speed VCT (Volume CT) used in this study is a new generation of 64-row volume CT. It is the fastest and most accurate CT scanning equipment up to now, bringing

CT scanning into a new "volume age". It can scan an organ in one second, the heart in five seconds, and the whole body in ten seconds. The scanning time is 1/4 of 16-row CT, the dosage of contrast agent is reduced by half, and the image resolution has been greatly improved. The results of this study showed that the accuracy rate of T, N and M phases before CT examination was 61.00%, 75.00% and 90.00%, which fully demonstrated the effectiveness of CT application in the diagnosis of TNM staging of gastric cancer before operation. However, the accuracy of CT staging for gastric cancer is between 76.00% and 83.30%, which is only 61.00% in this study, which is significantly lower than that reported in the literature. The reason may be that CT staging is mainly based on the depth of invasion of gastric cancer tissues. When the tumors are small, because of the relationship between CT resolution, the observation of low density zones corresponding to the submucosa is unsatisfactory.

Dual contrast-enhanced ultrasonography is a new diagnostic method compared with other TNM staging methods for gastric cancer. It is based on oral gastric window contrast-enhanced ultrasonography, and further uses ultrasound venography to analyze the blood flow perfusion of the lesion. The diagnostic method was based on the characteristics of "positive imaging" in arterial phase and "negative imaging" in venous phase, and T staging was performed according to the range of these two areas. Studies have shown that when gastric cancer tissue in the gastric wall continues to grow, the local blood supply will become more abundant, and the blood supply of cancer focus will be higher than that of other areas. In the case of advanced gastric cancer, the blood supply of the cancer is higher than that of the surrounding normal gastric wall tissue. In this case, double contrast-enhanced ultrasonography is helpful to improve the accuracy of T staging. The results of this study showed that the overall accuracy rate of double contrast-enhanced ultrasound T examination was 81.00%, which was significantly higher than that of CT examination ($P < 0.05$). This indicated that double contrast-enhanced ultrasound had a better effect on the accuracy of T staging examination. It effectively overcomes the limitation of low density of submucosa when CT examination is limited by small tumors. In Zhang Yuan's study, the total accuracy rate of CT staging was 46.8%, while that of double contrast-enhanced ultrasound was 68.1%. Double contrast-enhanced ultrasound was higher than that of CT. For lymph node metas-

tasis and distant metastasis in patients with gastric cancer, both CT and dual contrast-enhanced ultrasonography need to use enhancers to meet the needs of lymph node metastasis. Studies have shown that when lymph node metastasis or distant metastasis occurs in patients with gastric cancer, capillary and blood supply will proliferate or increase in varying degrees. CT and dual contrast-enhanced ultrasound generally use different enhancers, but they are related to local blood supply and capillary density, so they can be used to detect lymph node metastasis and distant metastasis. The results showed that there was no significant difference in the total detection rate of N-phase and M-phase between CT and double contrast-enhanced ultrasound in TNM staging of gastric cancer ($P > 0.05$). Both of them were maintained at a high level, suggesting lymph node metastasis or distant metastasis in patients with gastric cancer before operation. In the survey of patients' satisfaction with examination, both CT and dual contrast-enhanced ultrasound remained at a high level, and the difference was not significant ($P > 0.05$). It indirectly showed that both CT diagnosis and dual contrast-enhanced ultrasound had a better effect, so that patients could be recognized.

In summary, CT and dual contrast-enhanced ultrasound have good results in the diagnosis of TNM staging in patients with gastric cancer before operation. Dual contrast-enhanced ultrasound has more advantages in T staging, and there is no significant difference in N staging and M staging. In order to further improve the accuracy of TNM staging in patients with gastric cancer before operation, it is suggested that multiple examinations should be combined to provide reference for early diagnosis and treatment of gastric cancer.

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Corresponding Author:
JUN WANG
(China)