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Retrospective Study

Efficacy of multi-slice spiral computed tomography in assessing gastric cancer recurrence among patients after endoscopic submucosal dissection

Assessing Gastric Cancer Recurrence with CT after Endoscopic Submucosal Dissection

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Abstract

BACKGROUND

Recurrence is the biggest concern of ESD-based treatment therapies for early gastric cancer (EGC)., Urgent development of simple and easy surveillance approaches will enhance clinical treatment of the disease.

AIM

we explored the role of CT recurrence assessment of EGC, treated with ESD.

METHODS

We retrospectively recruited patients from our endoscopy department, between January 2002 and December 2015, and analyzed their basic characteristics, including symptoms, CT results, and results of endoscopy with biopsy, among others.

RESULTS

Among a total of 2150 patients EGC patients surveyed, 1362 met our inclusion and exclusion criteria and were therefore enrolled in our study. The cohort's sensitivity of CT for recurrent gastric cancer and specificity were 44.22% and 43.86%, respectively, with negative and positive predictive values of 40.15% (275/685) and 48.01% (325/677), respectively. The AUC of arterial and venous CT values for recurrent EGC were 0.545, and 0.604, respectively. ROC revealed no statistically significant differences between arterial and venous CT values for recurrent EGC.

CONCLUSION

Enhanced CT has superior diagnostic efficacy, but less accuracy, compared to gold standard techniques in patients with recurrent early gastric cancer.

Key Words: CT; Early gastric cancer; Gastric cancer

Yin JJ, Hu X, Hu S, Sheng GH. Efficacy of multi-slice spiral CT in assessing gastric cancer recurrence among patients after endoscopic submucosal dissection. *World J Gastrointest Oncol* 2023; In press

Core Tip: Development of a simple and easy approach to detect recurrence of early gastric cancer (EGC) treated with endoscopic mucosal exfoliation (ESD) is imperative to effective clinical therapy. Here, we report multi-slice spiral CT, a quick and convenient auxiliary examination with sensitivity and specificity values of 44.22% and 43.86%, respectively, for the predictive efficacy of arterial and venous CT values for recurrent EGC, which are far from satisfactory. AUC value of arterial and venous CT values for recurrent EGC respectively were 0.55 and 0.60, indicating that enhanced CT can effectively predict EGC, albeit with low accuracy.

INTRODUCTION

Gastric cancer (GC), a disease ranked 5th and 4th with regards to incidence and mortality rates, respectively worldwide as of 2020, is associated with a heavy economic burden[1]. In some Asian countries, such as Korea, China, and Japan, GC is the most prevalent type of cancer and the leading cause of cancer-related deaths[2]. Early detection and treatment is considered the most effective way for reducing GC-related mortalities. Early gastric cancer (EGC) is a key stage of gastric cancer, characterized by invasion of cancer cells no deeper than the submucosa, regardless of lymph node metastasis. Studies have shown that the 5-year survival rate of EGC operative treatment is approximately 90%[3].

Various operative therapies, such as subtotal gastrectomy, endoscopic submucosal dissection (ESD), and endoscopic mucosal resection (EMR), have been developed for treatment of GC. Among them, ESD, which was developed by Japan in the late 1990s, is the current standard technique in most East Asian countries[4]. ESD, which is based on endoscopic mucosal dissection (EMR), is a minimally invasive procedure that has been used for treatment of early gastrointestinal swelling tumor. Notably, the technique is

minimally invasive, has a lower recurrence rate, lower risk, and faster recovery compared to traditional surgical procedures [5, 6]. Tanabe *et al* [7] conducted a long-term multicenter collaborative study, and found that ESD was efficacious against EGC. However, ESD application is significantly limited by recurrence, with studies reporting local recurrence rates was between 2.8% and 38.5% based on studies with a median follow-up of 15-36 mo[8, 9]. Therefore, urgent development of simple and easy approaches to detect recurrence of EGC is imperative to effective treatment of the disease. Several "gold standard" diagnostic techniques for GC have been developed and applied, including endoscopy with biopsy, computed tomography (CT), endoscopic ultrasonography (EUS) and sometimes diagnostic laparoscopy [10]. Based on patient acceptance, CT has shown excellent promise, whereas enhanced spiral CT scan has a high resolution thus can provide a basis for the identification of gastric cancer lesions. To date, however, the role of enhanced spiral CT scan in recurrence assessment of gastric cancer patients after endoscopic submucosal dissection remains unclear.

In the present study, we explored this role with the aim of generating insights to guide future development of diagnostic and treatment approaches.

MATERIALS AND METHODS

This retrospective study was approved by the department of Radiology, Huangshi Maternity and Children's health Hospital, Affiliated Maternity. This study was approved by the Ethics committee of our hospital. And all patients signed an informed consent form prior to inclusion in the study.

Patient recruitment and selection criteria

We searched our endoscopy department database for patients who were diagnosed with EGS and received ESD treatment between January 2000 and December 2015. The inclusion criteria were as follows: 1) Patients with early gastric cancer who received ESD treatment; 2.) The patient has been returned regularly for more than 5 years; 3) No other cancer disease occurred after ESD treatment; 4) Signed informed consent to

participate in our study; and 5) CT and endoscopy with biopsy was chosen as the tool to detect EGC recurrence. Patients who met the following criteria were excluded from the study: 1) EGS was diagnosed as other type of cancer at the same time; and 2) had missing data.

Study design

This was a retrospective cohort study. We searched for eligible patients in the database at our endoscopy department from January 2002 to December 2015. In cases where CT or the patients' symptoms indicated there was any chance of EGC recurrence, then endoscopy with biopsy were checked for definitive diagnosis. We collected each patient's basic characteristics, including their symptoms, CT results, and results of endoscopy with biopsy, among others.

Computed tomography imaging and analysis

All subjects were asked to fast for 8 h, then given water to fill their stomachs and bowel. The patients were placed in the supine position and scanned on the Siemens 64-slice spiral CT system under the following parameters: tube current 250 mA, voltage 120 kV, layer thickness 5~10 mm, layer distance 0.5 mm, and pitch 1. Briefly, a plain scan was first performed from the top of diaphragm to the iliac crest. Next, 300 mg/mL of the contrast agent iodophenyl (plant Home: Shanghai Yuanye Biotechnology Co., LTD), injection rate was 3.5mL /s, Gastrointestinal arterial phase (delay time 20-25 s), portal venous phase (delay time 40~45 s), delay period (delay time 120~180 s) to implement enhanced scanning CT values of the arterial and portal venous phases were described and measured.

Histopathological examination

We employed gastroscopic biopsy to obtain 1362 specimens from patients with recurrent EGC, which were subsequently fixed using formaldehyde, embedded in paraffin, sectioned and stained with hematoxylin and eosin (H&E). Visible dilated

lymphatic vessels were distributed in the lamina propria of the intestinal mucosa, submucosa, muscular layer, and the serosal layer. The stained sections were evaluated by two physicians with wide experience in pathological diagnosis.

Statistical analysis

Data were statistically analyzed using packages implemented in R 4.1.0 software, unless otherwise indicated. Descriptive statistics were used to report patients, patients' symptoms, CT results, and results of endoscopy with biopsy. Continuous variables were presented as means and standard deviation (SD). Diagnostic efficacy was based on Receiver Operating Characteristic Curve (ROC), and the roc.test function in pROC package used to compare CT values between the arterial stage and portal stage groups during EGC.

RESULTS

Patient characteristics

We initially recruited a total of 2150 patients, who were diagnosed with EGC at our department, of which 1890 underwent ESD. A total of 1362 patients met our inclusion criteria and therefore included in the final analysis (Figure 1). Patient characteristics and recurrent EGC parameters are outlined in Table 1.Summarily, 49.71% (677/1362) of the patients exhibited EGC recurrence, with the condition found to be highly occur in the lower place of stomach. The most TNM stage of recurrent EGC was T1b.

Diagnostic value

CT sensitivity and specificity for recurrent GC were 44.22% (325/735), and 43.86% (275/627), respectively, with negative and positive predictive values of 40.15% (275/685), and 48.01% (325/677), respectively. The Youden's index was -0.12.

CT enhancement characteristics for recurrent EGC

CT, gastroscopic, and histopathological examination results for patients with recurrent EGC are presented in Figure 2. Summarily, patients without recurrent EGC had a mean arterial CT and venous CT values of 60.77, and 42.67, respectively. The mean values for the On the other hand, patients with recurrent EGC had mean arterial CT and venous CT values of 69.52, and 62.21, respectively. Predictive efficacy of arterial and venous CT values for early gastric cancer are summarized in Figure 2. Summarily, a total of 473 (69.87%) and 204 (30.13%) cases exhibited obvious enhancement in the arterial and portal vein phase of the lesions, respectively. The enhancement ranged between 40-70hu. The enhanced lesions had a slightly rough surface, which could also be accompanied by mild nodular or indentation changes. The gastric wall was also slightly stiff.

ROC curve reveal recurrent early gastric cancer

The predictive efficacy of arterial and venous CT values for patients with recurrent EGC is presented in Figure 3. Summarily, the AUC values for arterial and venous CT values for recurrent EGC were 0.545, and 0.604, respectively. Resulting ROC curves revealed no statistically significant differences between arterial and venous CT values for recurrent EGC ($P = 0.001$)

DISCUSSION

The symptoms of early gastric cancer are nonspecific, easy to be confused with other benign lesions, and often have entered the late stage when diagnosed, a phenomenon that leads to poor clinical treatment effect. Therefore, early screening and diagnosis of gastric cancer is imperative to prolonging the life of patients. Studies have shown that early gastric cancer patients who were treated with ESD still face the possibility of recurrence, thus should be subjected to early screening[11-13]. Although gastroscopy biopsy is the gold standard technique for GC diagnosis, it has poor acceptability among patients due to various shortcomings, key among them complicated examination and painful procedures, as well as high costs[14].

Enhanced spiral CT scan generates high resolution images, thus can provide a basis for identification of gastric cancer lesions. Studies have shown that application of phase III enhanced multi-slice spiral CT and window technique can increase its diagnostic efficacy in patients with early gastric cancer[15-17]. In the present study, we found that Multi-layer helical CT enhanced imaging with narrow window + raised window has reduced image layers, with less display content, but revealed clear details, which offers critical advantages in the discovery and detection of subtle lesions. In addition, the lesions exhibited morphology and enhancement characteristics that were in sharp contrast with those of the adjacent normal gastric wall. When the lesion showed a single layer structure, the gastric wall of the lesion was significantly enhanced in non-permeability with focal thickening of the gastric wall or only significantly enhanced without thickening of the gastric wall. When the lesion showed a multi-layer structure, the gastric wall was thickened and significantly enhanced without sudden disappearance of the middle and outer layers. At the lesion site, mucosal enhancement was obvious in arterial and portal vein stages, and basically subsided at the equilibrium stage. Some studies have reported the value of enhanced CT in the diagnosis of gastrointestinal neoplasms[18-21]. Standard window can meet the needs of general diagnosis, narrow window width, less layers, less display content, but clear details, increase the picture image contrast, improve the resolution of lesions and surrounding tissues, as well as improve the blackening of images displayed on the window screen. Moreover, enhanced lesion tissues appear on a good background due to the high CT value, whereas obvious superior substandard can be shown for local subtle enhanced lesions in the stomach wall.

In the present study, most positive patients exhibited enhancement in both arterial and venous phases. However, there were still cases of missed diagnosis (55.78%). The technique used herein had sensitivity and specificity rates of 44.22% and 43.86%, respectively, which are far from satisfactory. However, the AUC of arterial and venous CT values for recurrent EGC was greater than 0.5, indicating that enhanced CT can predict EGC, albeit with low accuracy.

This study had some shortcomings. Firstly, this was a retrospective study. Secondly, some patients' data records were not detailed, which necessitated their elimination from the study, thus affecting the sample size.

CONCLUSION

Enhanced CT has superior diagnostic efficacy but lower accuracy in patients with recurrent early gastric cancer, compared to gold-standard techniques. Application value of CT in recurrent gastric cancer needs more extensive research.

ARTICLE HIGHLIGHTS

Research background

There is an urgent need to develop a simple and easy approach for screening for EGC recurrence in patients treated with ESD.

Research motivation

Multi-slice spiral CT is a quick, convenient and promising auxiliary examination. Enhanced spiral CT scan generates high resolution images, thus can provide a basis for the identification of gastric cancer lesions.

Research objectives

To explore the role of CT recurrence assessment in EGC patients who were treated with ESD.

Research methods

This retrospective study recruited patients from the endoscopy department between January 2002 and December 2015. Basic characteristics, symptoms, CT results, and endoscopy with biopsy findings were analyzed. Sensitivity, specificity, negative and positive predictive values of CT for recurrent gastric cancer were calculated. Arterial and venous CT values were evaluated using area under the curve (AUC) analysis, and

ROC analysis compared their performance for detecting recurrent EGC. The diagnostic efficacy and accuracy of enhanced CT were assessed in comparison to gold standard techniques for detecting recurrent early gastric cancer.

Research results

The approach had sensitivity and specificity rates of 44.22% and 43.86%, respectively, which are far from satisfactory. AUC value of arterial and venous CT values for recurrent EGC was greater than 0.5, indicating that enhanced CT can predict EGC, albeit at low accuracy.

Research conclusions

Enhanced CT has superior diagnostic efficacy but lower accuracy than gold standard techniques in patients with recurrent early gastric cancer.

Research perspectives

Multi-slice spiral CT is valuable in early gastric cancer screening.

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