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Analysis of the detection rate and clinical characteristics of early gastric cancer by painless gastroscopy and ordinary gastroscopy

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Abstract

Objective: To investigate the difference of early gastric cancer (EGC) detection rate and endoscopic characteristics between painless and ordinary electronic gastroscopy, and summarize the clinical data of gastric cancer (GC) patients.

Methods: Clinical data of 72,000 patients who underwent gastroscopy in the First People Hospital of Huzhou (Zhejiang, China) from January 2016 to December 2021 were retrospectively analyzed. The patients were divided into painless gastroscopy group (observation group, 36,000 cases) and ordinary gastroscopy group (control group, 36,000 cases) according to the examination methods. The detection rate of EGC between the 2 groups and the endoscopic characteristics of EGC lesions between the 2 groups were compared, and the clinical data of GC were summarized.

Results: Painless gastroscopy is safer than ordinary gastroscopy. The detection rate of GC and EGC in the observation group was significantly higher than that in the control group ($P < .05$); the difference between the 2 groups in the detection rate of advanced GC was not statistically significant. The average length of EGC lesions in the observation group was significantly shorter than that in the control group ($P < .05$). The proportion of EGC with lesion length <2.0 cm in the observation group was significantly higher than that in the control group ($P < .05$). The proportion of EGC lesions with type II morphology, normal or pallor mucosal color, and no rupture in mucosa in the control group were significantly lower than that in the observation group, respectively ($P < .05$). The proportion of EGC distributed in the cardia, fundus and corpus was higher in the observation group than in the control group ($P < .05$). The incidence of helicobacter pylori (HP) infection, precancerous diseases, first-degree relatives of GC patients, and risk factors in patients with GC was significantly higher than that in non-GC patients ($P < .05$), multivariate logistic regression analysis showed that these were independent influencing factors for the occurrence of GC.

Conclusion: Painless gastroscopy can effectively improve the screening and diagnostic efficiency of EGC, especially for EGC lesions that are not easy to expose the site, small in size, superficial, without obvious mucosal color change or without mucosal breakage. Therefore, the value of painless gastroscopy in EGC screening is worth further promotion and research.

Abbreviations: EGC = early gastric cancer, GC = gastric cancer, HP = helicobacter pylori.

Keywords: clinical characteristic, early gastric cancer, ordinary gastroscopy, painless gastroscopy

1. Introduction

Gastric cancer (GC) is a malignant tumor worldwide, according to the latest statistics from the Global Cancer Incidence and Mortality Information Center (GCIMC), by 2020, there will be approximately 1089,000 new cases of GC and 769,000 deaths worldwide.[1] Worldwide, the prevalence of GC shows significant differences in geography and population distribution, and East Asian countries, such as South Korea, Japan, and China, have shown a significant increase in the incidence and mortality of GC when compared with North American, Western European, and African countries.[2–4] Among 185 countries in the world, China has the highest incidence and fatality rate of GC, about 43.9% and 48.6% respectively.[1] In 2016, there were about 397,000 new cases of GC in China, of which 277,000 were men and 120,000 were women; there were about 288,500 deaths from GC in China, of which 202,200 were men and 88,400 were women; the number of incidence cases and the number of deaths ranked third among all malignant tumors.[5] The survival time of GC patients is closely related to the time of clinical diagnosis. Early gastric cancer (EGC) is defined as cancer tissue limited to the mucosa

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The datasets generated during and/or analyzed during the current study are available from the corresponding author on reasonable request.

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and submucosa, regardless of lymph node metastasis.[6] Early symptoms of GC are not obvious, and most patients are already in the middle or late stage when diagnosed, the 5-year survival rate of these patients is still lower than 30% even if they receive surgical treatment, while the 5-year survival rate of EGC patients can be higher than 90% after timely treatment.[7–9] Therefore, early detection and treatment is the most effective way to improve the prognosis of GC.[10,11] The detection rate of EGC in China accounts only for 5% to 20% of total GC, much lower than Japan (70%) and Korea (50%).[12] Therefore, the 5-year survival rate of GC patients in China from 2010 to 2014 was 35.9%, which was significantly lower than the 68.9% and 60.3% in South Korea and Japan during the same period, which may be related to the low diagnosis rate of EGC in China.[13] Gastroscopy and endoscopic biopsy are the gold standard for the diagnosis of GC. Ordinary gastroscopy is suitable for detecting progressive GC, but its effectiveness in detecting EGC is not stable.

On the one hand, the lens of the gastroscope must enter the gastrointestinal tract through the oropharynx during the procedure, which can easily cause pain, nausea and vomiting, and even asphyxia,[14] and many people refuse gastroscopy for this reason; on the other hand, the endoscopic manifestations of EGC are not obvious, and the uncomfortable reactions of patients during ordinary gastroscopy may easily limit the observation effect.[15] Painless gastroscopy provides optimal conditions for gastrointestinal endoscopists, improves patient satisfaction with gastrointestinal endoscopic procedures, and minimizes the risk of injury and accidents during the procedure.[16] More importantly, painless gastroscopy can fully exposure the visual field, improve the precision rate of biopsy, thereby reducing the rate of missed diagnosis and misdiagnosis, which has a positive significance for the early diagnosis and treatment of EGC in theory.

To date, few studies have evaluated the value of painless gastroscopy for the detection rate of EGC. This study attempted to explore and explain the advantages of painless gastroscopy in EGC screening by retrospective analysis of clinical data and endoscopic characteristics of 72,000 patients with gastroscopy.

2. Materials and methods

2.1. Materials

Clinical data of 72,000 patients who underwent painless gastroscopy or ordinary gastroscopy in First People Hospital of Huzhou (Zhejiang, China) from January, 2016 to December, 2021 were retrospectively analyzed. A total of 72,000 cases were divided into control (ordinary gastroscopy, n = 36,000) and observation (painless gastroscopy, n = 36,000) groups, all patients' gastroscopy and diagnosis were done by senior endoscopists, and the diagnosis of GC was made by pathological histology as the gold standard. There was no significant difference in sex, age, early symptoms between the 2 groups ($P > .05$) (Table 1). The current study was approved by the Medical Research and Clinical Trial Ethics Committee of First People Hospital of Huzhou. Signed written informed consent was obtained from the patients.

Inclusion and exclusion criteria were as follows: assessment of cardiopulmonary function, exclusion of serious medical diseases, and those with serious impairment of important organ functions such as heart, lung, liver and kidney; those without pathology; those with incomplete medical record information; signed written informed consent was obtained from the patients.

2.2. Operation methods

Gastroscopy Examination was performed using the Japanese OLYMPUS CV290 image processing apparatus and OLYMPUS Gif-HQ290 electronic gastroscopy. Electrocardiogram monitor, mask, oxygen supplies and narcotic drugs were prepared. All patients were routinely fasting and water abstention before gastroscopy, dclonine hydrochloride gelatin (Yangtze River Pharmaceutical Group, Ltd., Jiangsu, China) and dimeticone (Jumpcan Pharmaceutical Group Co., Ltd., Jiangsu, China) were taken orally 10 minutes before the examination. The control group underwent gastroscopy in the left lateral position after the throat had numbness. The observation group in the left lateral position and propofol intravenously (Beijing Fresenius Kabi Pharmaceutical Co., Ltd., Beijing, China), the gastroscopy was performed when patients lost consciousness relevant reflex disappeared, muscle relaxed and vital signs stabilized, maintain a low flow of oxygen through the nasal catheter during the examination.

2.3. Observation indicators

Examination of intraoperative and postoperative adverse reactions in both groups of patients; The detection rates of GC at different periods in the 2 groups were analyzed respectively. The endoscopic length of EGC lesions was divided into ≤ 1.0 cm, 1.0 cm to 2.0 cm and ≥2.0 cm, and to compare the proportion of EGC with different lesion lengths in the 2 groups; (iv) Based on the 2005 Paris classification criteria,[17] EGC lesion morphology was divided into type I, type IIa (including type IIa + IIc), type IIb, type IIc (including type IIc + IIa), and type III (type IIc + III and III + IIc), and to compare the proportion of EGC with different lesion morphologies in the 2 groups; The lesion locations of EGC were divided into cardia, fundus, corpus, angularincisure, and antrum, and to compare the proportion of EGC with different lesion locations in the 2 groups; The mucosal colors of EGC lesions were divided into erythema, normal and pallor, and to compare the proportion of EGC with different lesion mucosal colors in the 2 groups; The mucosal rupture of EGC lesions were divided into erosion, shallow ulcer and no rupture, and to compare the proportion of EGC with different lesion mucosal ruptures in the 2 groups; The rates of helicobacter pylori (HP)

Table 1

Comparison of general information of the 2 groups.

Groups	n	Age (yr)	Sex (cases)		Symptoms (cases)			
			Male	Female	Bloating, early satiety, anorexia	Nausea, vomiting, stomach ache	Hematemesis, melena	Asymptomatic
Control	36,000	63.7 ± 8.4	18,479	17,521	19,291	11,472	896	4341
Observation	36,000	62.1 ± 7.7	18,814	17,186	19,670	10,974	817	4539
t/χ^2	-	8.81	11.02		13.14	9.28	8.77	12.47
P value	-	.28	.37		.31	.92	.61	.47

infection, precancerous diseases (including chronic atrophic gastritis, gastric ulcer, gastric polyp, post-surgical residual stomach, hypertrophic gastritis), first-degree relatives of GC patients, and risk factors of GC (including high-salt diet, pickled diet, smoking, alcohol consumption) were counted for all patients, and the above clinical data were further compared between patients with GC and those without GC.

2.4. Statistical analysis

SPSS 20.0 statistical software (SPSS, Inc., Chicago, IL) was used for the statistical analyses. Measurement data were expressed as mean ± SD, and comparisons between groups were performed using t-test. Countable data were compared using the χ^2 test. Multivariate logistic regression analysis was used to analyze the related factors affecting GC. $P<.05$ was considered to indicate a statistically significant analysis.

3. Results

3.1. Comparison of intra- and postoperative adverse reactions between the 2 groups

The incidence of intra- and postoperative adverse reactions including nausea, vomiting, cough, dysphoria and throat discomfort were significantly lower in the observation group compared with the control group ($P < .05$). Thus, painless gastroscopy can reduce the incidence of intra- and postoperative adverse reactions (Table 2).

3.2. Comparison of the detection rates of GC in different periods between the 2 groups

Control group: Total 328 cases of GC (detection rate 0.91%), including 72 cases of EGC (detection rate 0.20%) and 256 cases of advanced GC (detection rate 0.71%). Observation group: Total 363 cases of GC (detection rate 1.01%), including 114 cases of EGC (detection rate 0.32%), 249 cases of advanced GC (detection rate 0.69%).

The detection rate of GC and EGC in the observation group was significantly higher than that in the control group ($P < .05$); the difference between the 2 groups in the detection rate of advanced GC was not statistically significant (Table 3).

3.3. Comparison of endoscopic characteristics of EGC between 2 groups

3.3.1. Comparison of the length of EGC lesions between 2 groups. In the control group, the average length of the lesions under endoscopy in 72 patients with EGC was 1.9 ± 1.2 cm. Thereinto, 7 patients with lesions ≤ 1.0 cm, 24 patients with lesions 1.0 cm to 2.0 cm, and 41 patients with lesions ≥ 2.0 cm. In the observation group, the average length of lesions under endoscopy in 114 patients with EGC was 1.2 ± 0.8 cm. Thereinto, 26 patients with lesions ≤ 1.0 cm, 54 patients with lesions 1.0 cm to 2.0 cm, and 34 patients with lesions ≥ 2.0 cm. The average length of EGC lesions in the observation group was significantly shorter than that in the control group, and the difference was statistically significant ($P < .05$). The proportion of EGC with lesion length < 2.0 cm in the observation group was significantly higher than that in the control group, and the difference was statistically significant ($P < .05$). The proportion of EGC with long diameter ≥ 2.0 cm in the observation group was lower than that in the control group, and the difference was statistically significant ($P < .05$) (Table 4).

3.3.2. Comparison of the morphology of EGC lesions between 2 groups. The lesion morphology of type I and type III EGC in the control group were 14 and 15 cases, and in the observation group were 15 and 11 cases, the proportion of EGC with type I and type III lesion morphology in the control group was significantly higher than that in the observation group, and the difference was statistically significant ($P < .05$). The lesion morphology of type IIa, type IIb and type IIc EGC in the control group were 24, 8 and 11 cases, and in the observation group were 44, 18 and 11 cases, the proportion of EGC with type IIa, type IIb and type IIc lesion morphology in the control group was significantly lower than that in the observation group, and the difference was statistically significant ($P < .05$) (Table 5).

3.3.3. Comparison of the location of EGC lesions between 2 groups. In the control group, 72 patients with EGC involved the cardia in 7 cases, the fundus in 4 cases, the corpus in 8 cases, the angularincisure in 22 cases, and the antrum in 31 cases. In the observation group, 114 patients with EGC involved the cardia in 15 cases, the fundus in 11 cases, the corpus in 22 cases, the angularincisure in 27 cases, and the antrum in 39 cases. The proportion of EGC distributed in the cardia, fundus and corpus were higher in the observation group than in the control group, and the difference was statistically significant ($P < .05$). The proportion of EGC distributed in the angularincisure and antrum were lower in the observation group than in the control group, and the difference was statistically significant ($P < .05$) (Table 6).

3.3.4. Comparison of the mucosal color of EGC lesions between 2 groups. In the control group of 72 patients with EGC, the mucosal color of the lesion was normal in 12 cases, erythema in 52 cases, and pallor in 8 cases. In the observation group of 114 patients with EGC, the mucosal color of the lesion was normal in 39 cases, erythema in 54 cases, and pallor in 21 cases. The proportion of normal and pallor mucosal color of EGC lesions in the observation group was higher than that in the control group, and the difference was statistically significant ($P < .05$). The proportion of erythema mucosal color of EGC lesions in the control group was higher than that in the observation group, and the difference was statistically significant ($P < .05$). (Table 7).

3.3.5. Comparison of the mucosal rupture of EGC lesions between 2 groups. In the control group of 72 patients with EGC, the mucosal rupture of the lesion was no rupture in 31 cases, erosion in 15 cases, and shallow ulcer in 26 cases. In the observation group of 114 patients with EGC, the mucosal rupture of the lesion was no rupture in 70 cases, erosion in 17 cases, and shallow ulcer in 27 cases. The proportion of no

Table 2

Comparison of intraoperative and postoperative adverse reactions between the 2 groups [n (%)].

Groups	n	Nausea, Vomiting	Throat is comfort	Cough	Dysphoria
Control	36,000	36,000(100.0)	24,817(68.9)	19,852(55.1)	9783 (27.2)
Observation	36,000	893 (2.5)	1189 (3.3)	1674 (4.7)	317 (0.9)
χ^2	-	79.156	58.315	49.178	20.618
P value	-	<.001	<.001	<.001	<.001

Table 3

Comparison of the detection rates of GC in different periods between the 2 groups [N(%)].

	Control (36,000 cases)		Observation (36,000 cases)			
	quantity	Detection rate(%)	quantity	detection rate(%)	χ^2	*P*
EGC	72	0.20	114	0.32	8.137	.007
AGC	256	0.71	249	0.69	1.242	.842
GC	328	0.91	363	1.01	6.187	.008

EGC = early gastric cancer, GC = gastric cancer.

Table 4

Comparison of the length of EGC lesions between the 2 groups [N(%)].

	≤1.0cm	1.0cm-2.0cm	≥2.0cm
Observation	26 (22.8)	54 (47.4)	34 (29.8)
Control	7 (9.7)	24 (33.3)	41 (56.9)
χ^2	5.363	9.174	15.770
P	.015	.024	.006

EGC = early gastric cancer.

Table 5

Comparison of the morphology of EGC lesions between 2 groups [N(%)].

	I	IIa	IIb	IIc	III
Observation	15(13.2)	44(38.6)	18(15.8)	26(22.8)	11(9.6)
Control	14(19.4)	24(33.3)	8(11.1)	11(15.3)	15(20.8)
χ^2	4.065	2.552	2.196	3.439	4.674
P	.027	.031	.044	.017	.009

EGC = early gastric cancer.

Table 6

Comparison of the location of EGC lesions between 2 groups [N(%)].

	Cardia	Fundus	Corpus	Angularincisure	Antrum
Observation	15((13.2)	11(9.6)	22(19.3)	27(23.7)	39(34.2)
Control	7(9.7)	4(5.5)	8(11.1)	22(30.6)	31(43.1)
χ^2	2.861	3.040	5.193	4.738	3.770
P	.042	.034	.014	.022	.019

EGC = early gastric cancer.

rupture in mucosa of EGC lesions in the observation group was higher than that in the control group, and the difference was statistically significant ($P < .05$). The proportion of erosion and shallow ulcer in mucosa of EGC lesions in the control group were higher than that in the observation group, and the difference was statistically significant ($P < .05$). (Table 8).

3.4. Comparison of clinical data between patients with EGC and non-GC patients

The rates of HP infection, precancerous diseases (chronic atrophic gastritis, gastric ulcer, gastric polyp, post-surgical residual stomach, hypertrophic gastritis), first-degree relatives of GC patients, and risk factors of GC (high-salt diet, pickled diet, smoking, alcohol consumption) in patients with GC and non-GC in this study were counted and compared, respectively. The results showed that the incidence of the above clinical data in patients with GC was significantly higher than that in non-GC patients, and the differences were statistically significant ($P < .05$) (Table 9).

Further, we took the above indicators as independent variables and the occurrence of GC as dependent variables to conduct multivariate logistic regression analysis, and the results showed that the above indicators were independent risk factors for the occurrence of GC (Table 10).

4. Conclusion

The curative effect and prognosis of GC are closely related to its stage, therefore, improving the early diagnosis rate of GC can help to improve the quality of life and prognosis of GC patients. Employing gastroscopy is imperative in the diagnosis of GC, which enables doctors to observe the lesions more directly and more importantly: the diagnosis of GC relies on biopsy under gastroscopy. Ordinary gastroscopy is an invasive operation with a high physiological and psychological impact on the subject, and many patients thus refuse to undergo the necessary gastroscopy, delaying the optimal clinical diagnosis and treatment.[18,19] Painless gastroscopy allows patients to quickly enter a state of sedation and sleep, and complete the gastroscopy in a comfortable and painless manner, with the advantages of safety,

Table 7

Comparison of the mucosal color of EGC lesions between 2 groups [N(%)].

	Normal	Erythema	Pallor
Observation	39(34.2)	54(47.4)	21(18.4)
Control	12(16.7)	52(72.2)	8(11.1)
χ^2	9.105	13.319	7.527
P	.004	<.001	.009

EGC = early gastric cancer.

Table 8

Comparison of the mucosal rupture of EGC lesions between 2 groups [N(%)].

	No rupture	Erosion	Shallow ulcer
Observation	70(61.4)	17(14.9)	27(23.7)
Control	31(43.1)	15(20.8)	26(36.1)
χ^2	14.164	5.179	10.873
P	<.001	.027	.011

EGC = early gastric cancer.

Table 9

Comparison of clinical data between patients with gastric cancer and non-gastric cancer patients [N(%)].

	Non-gastric cancer(n = 71309)	GC (n = 691)	χ^2	*P*
HP infection	34,228(48.0)	475(68.8)	24.319	<.001
Precancerous diseases	10,554(14.8)	282(40.8)	19.764	<.001
First-degree relatives of gastric cancer patients	1355(1.9)	52(7.5)	3.287	.014
Risk factors of gastric cancer	16,829(23.6)	223(32.3)	11.089	.009

GC = gastric cancer, HP = helicobacter pylori.

Table 10

Multivariate logistic regression analysis of gastric cancer.

	β	SE	Wald χ^2	*P*	OR	95%CI
HP infection	0.833	0.334	6.221	.013	2.300	1.195～4.426
Precancerous diseases	1.032	0.753	3.194	.033	2.546	0.153～0.586
First-degree relatives of gastric cancer patients	0.766	0.316	5.886	.015	2.152	1.159～3.996
Risk factors of gastric cancer	0.358	0.331	5.342	.024	1.473	1.034～4.043

HP = helicobacter pylori.

comfort and high efficiency, which is widely used in the clinic, and expands the range of indications compared with that of ordinary gastroscopy.

In the present study, compared with the ordinary gastroscopy group, no obvious discomfort, nausea, vomiting, cough, dysphoria, or pharyngeal discomfort was found in the painless gastroscopy group. The study further compared the detection rates of early and advanced GC in the 2 groups. The results showed that the detection rate of advanced GC was similar between the 2 groups, and the detection rate of EGC in the observation group was significantly higher than that in the control group, thus the overall detection rate of GC in the observation group was significantly higher than that in the control group. Gastroscopic diagnosis of EGC is difficult, because lesion of EGC is very complex or subtle so that it may be missed during gastroscopy. We believe that inadequate exposure of gastric mucosa caused by adverse reactions during the operation of common gastroscopy affects the observation of suspected lesions, thus reducing the corresponding detection rate of EGC.

We further counted the endoscopic characteristics such as lesion length, morphology, location, mucosal color and mucosal rupture in the 2 groups of patients with EGC. The aim was to analyze the advantages of painless gastroscopy for EGC screening by comparing the proportion of EGC under each endoscopic characteristics between the 2 groups. Results show that painless gastroscopy is more advantageous for detecting small, superficial, normal mucosal color and no mucosal rupture EGC lesions. Many studies have found that EGC with diameter < 20mm is the most common, which is also consistent with the results of this study.[20,21] The diameter of EGC lesion ≤ 20mm belongs to the absolute indication of endoscopic treatment and can achieve the effect of curative resection.[22] In this study, type II was the most common morphological feature of EGC lesions, which was consistent with previous studies.[20,21] The mucosal color of EGC under white light endoscope is related to its histological type. Numerous studies have confirmed that the mucosa color of most differentiated carcinomas is erythema, and undifferentiated carcinomas is normal or pallor.[23] With the gradual decline of HP infection, superficial flat type of EGC gradually increased,

and the mucosal color was usually normal or pallor, suggesting a low degree of differentiation.[24] Most studies show that EGC lesions tend not to be complicated by erosions or ulcers, while complicated erosions or ulcers are often indicative of deep infiltration.[25]

Meanwhile, this study also showed that painless gastroscopy is more advantageous for the detection of EGC lesions located in the cardia, fundus and corpus. Our analysis suggests that anesthesia results in more adequate exposure of the gastric lumen and a more stable and clear microscopic field of view, thus making the observation more adequate and the endoscopic biopsy more accurate.

Nevertheless, Painless gastroscopy is not accessible to all due to cost burden, anesthesia-related risks, and personal wishes. If so, under the premise of conforming to the indications of painless gastroscopy, what kind of people is recommended for EGC screening by painless gastroscopy? We further statistically analyzed the general clinical data of all patients in an attempt to answer this question. We calculated the incidence of HP infection, previous relevant precancerous diseases (chronic atrophic gastritis, gastric ulcer, gastric polyps, post-surgical gastric remnants, and hypertrophic gastritis), first-degree relative GC status, and risk factors for GC (high-salt diet, pickled diet, cigarette smoking, and alcohol consumption) in all patients. We compared the clinical data of GC patients and non-GC patients, and found that the rate of HP infection, previous precancer diseases, first-degree relative GC, and GC risk factors in GC patients were significantly higher than those in non-GC patients. Multivariate logistic regression showed that these 4 indexes were independent risk factors for GC. Therefore, painless gastroscopy for high-risk groups of GC is conducive to increasing the detection rate of EGC.

As we all know, gastroscopy is the basis of EGC screening. With the popularity of painless gastroscopy, most medical institutions have the ability to perform painless gastroscopy. With the maturity and popularization of endoscopic screening theory for EGC, endoscopists' ability to identify EGC has been greatly improved. Our study found that compared with ordinary gastroscopy, painless gastroscopy can effectively improve the screening and diagnostic efficiency of EGC, especially for EGC lesions that are not easy to expose the site, small in size, superficial, without obvious mucosal color change or without mucosal breakage. However, as a single-center retrospective study, this study has limitations such as inability to randomize, selection bias, lack of multicenter data, and lack of follow-up data. Therefore, we believe that it is worthwhile to conduct a multicenter randomized controlled study to confirm the long-term efficacy and safety of painless gastroscopy for EGC screening.

Author contributions

Conceptualization: Tongyun He.
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