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A Comprehensive Study on the digestive Endoscopic Technique and Narrow-Band Imaging for Early Gastric Cancer Screening

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Abstract: *Objective:* To explore the implementation of gastrointestinal endoscopy technology and endoscopic narrow-band imaging (NBI) in the early screening of gastric cancer and to observe and study their application effects. *Methods:* During the period from March 2023 to August 2023, 312 patients who received gastroscopy in the Kunming Guandu District People's Hospital were selected, and they underwent both conventional gastroscopy and endoscopic NBI, with clinicopathological tissue biopsy serving as the gold standard. The application value for early screening of gastric cancer was observed and analyzed. *Results:* The scoring data showed that the clarity of gastric mucosal glandular tube structure, microvascular structure clarity, and lesion contour scoring data of conventional gastroscopy were lower than those of the NBI technology ($P < 0.05$). The screening rate of pathological biopsy in 312 patients was 18.59% (58 cases). Conventional gastroscopy showed a screening rate of 11.53% (36 cases), while NBI technology examined a screening rate of 17.63% (55 cases), and the two-by-two comparison of the screening rate data of the three groups was not statistically significant ($P > 0.05$). The sensitivity, specificity, accuracy, positive predictive value, and negative predictive value of conventional gastroscopy appeared to be lower than those of NBI technology ($P < 0.05$). *Conclusion:* In the early screening of gastric cancer, endoscopic NBI technology can be applied to patients. Compared with conventional gastroscopy, it provides a clearer visualization of the structure of the gastric mucosal glandular structure and microvascular structure, with a certain screening rate. Additionally, its sensitivity, specificity, accuracy, positive predictive value, and negative predictive value are higher, demonstrating outstanding effectiveness.

Keywords: Gastric cancer; Early screening; Gastrointestinal endoscopy technology; Endoscopic narrow band imaging technology; Application effect

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1. Introduction

Gastric cancer, a common malignant tumor of the digestive system, underscores the significance of early detection and treatment for improving treatment success and patient survival [1,2]. Among the existing screening methods for gastric cancer, gastrointestinal endoscopy and non-invasive techniques are prominent, with gastrointestinal endoscopy being a widely employed approach [3]. The technique involves the insertion of a flexible tube (endoscope) through the oral or nasal cavity to reach the stomach for examination and diagnosis. On the other hand, endoscopic narrow-band imaging (NBI) represents an advanced application of endoscopic technology. NBI utilizes special spectral filters to accentuate the reflection and absorption characteristics of specific wavelengths of light in the gastric mucosa, thereby increasing the detection rate of gastric cancer and other lesions. Its efficacy in gastric cancer screening has been well-documented [4,5]. Studies indicate that NBI technology can enhance the detection rate of early gastric cancer and precancerous lesions while reducing the misdiagnosis and leakage rates [6]. In addition, NBI technology can reveal small and hidden lesions, providing a more accurate basis for the diagnosis and treatment of early gastric cancer [7,8]. The implementation of gastrointestinal endoscopy technology and its advanced application in NBI technology for gastric cancer screening holds significant value. This approach assists doctors in more accurately diagnosing early gastric cancer and precancerous lesions, thereby improving the success rate of treatment and patient survival [9]. Building on these considerations, this paper selects relevant patients to explore the implementation of gastrointestinal endoscopy technology and endoscopic NBI technology in gastric cancer screening, aiming to observe and study their application effects.

2. Materials and methods

2.1. General information

The study period spanned from March 2023 to August 2023, during which 312 patients who underwent gastroscopy at Kunming Guandu District People's Hospital were selected. All participants underwent both conventional gastroscopy and endoscopic NBI. Among them, 185 cases were male, and 127 cases were female. The age distribution ranged from 27 to 77 years old, with an average age of 55.61 ± 12.87 years. Body mass measurements ranged from 46 to 67 kg, with an average weight of 49.77 ± 13.52 kg.

2.2. Inclusion and exclusion criteria

Inclusion criteria included: (1) Patients involved were capable of undergoing gastroscopy; (2) Informed consent was obtained from all patients; (3) Patients exhibited good cooperation and were able to engage in normal communication; (4) Approval for this study was obtained from the relevant departments.

Exclusion criteria included: (1) Patients allergic to the dye and other materials used in this study or those with congenital allergies; (2) Individuals with severe heart and lung diseases; (3) Patients who recently used non-steroidal anti-inflammatory drugs; (4) Individuals with mental disorders.

2.3. Methods

All participating patients underwent conventional gastroscopy and endoscopic NBI according to the following protocol:

(1) Preparation: In this study, all patients were instructed to adopt a light diet the night before the examination and abstain from eating after 12 midnight. Patients were also informed that they needed to undergo the examination on an empty stomach on the day of the examination.

(2) Instruments used: The instruments employed in this study included the CV-260sL electronic processor, the CLV-260SL endoscopic light illumination system, and the Olympus GIF-H260 electronic gastroscope.

(3) Routine endoscopy procedure: The standard endoscopy procedure involves the patient being positioned for the endoscopy entry. The examination started from the descending end of the

duodenum, gradually moving the scope to observe the bulbous lumen, pylorus, gastric sinus, gastric body, and gastric fundus. Upon the identification of the lesion tissue, a biopsy was performed to obtain samples for further analysis.

(4) Endoscopic NBI: Upon locating the lesion tissue, the NBI-ME mode was utilized to observe vascular microstructural changes on the surface of the lesion, aiding in determining the infiltration depth. The final step involved taking a sample biopsy of the lesion tissue under endoscopy and sending it for examination.

(5) Examiner consistency: All examinations were consistently performed by the same experienced endoscopist.

2.4. Observation indexes

(1) Comparison of gastric structure clarity: This involves assessing the clarity of gastric mucosal glandular ducts and microvascular structure and lesion contours in both conventional gastroscopy and NBI. The scale categorizes clarity into four grades. (i) Score of 1: The patient's examination image is blurred, making it challenging to recognize microstructures and lesion outlines; (ii) Score of 2: The patient's examination image is blurred, but the microstructure of the gastric mucosa and the outline of the lesion are recognizable; (iii) Score of 3: The patient's examination image is relatively clear, and the microstructure of the gastric mucosa and the outline of the lesion are easily recognizable; (iv) Score of 4: The patient's examination image is very clear, allowing for a distinct view of the microstructure of the gastric mucosa and the outline of the lesion.

(2) Screening results: Analyzing and comparing the screening rates of pathological biopsy results between conventional gastroscopy and NBI.

(3) Diagnostic efficacy: Calculating the diagnostic sensitivity, specificity, accuracy, positive predictive value, and negative predictive value of early gastric cancer using conventional endoscopy and NBI technology.

2.5. Statistical methods

SPSS 22.0 was used for relevant statistical analyses. Count-related data were expressed as percentages (%), and the χ^2 test was employed for statistical analysis of results. Measurement-related data were expressed as mean ± standard deviation (SD), and the *t*-test was employed, with $P < 0.05$ considered statistically significant.

3. Results

3.1. Comparison of gastric structural clarity

The scoring data revealed that the structural clarity of the gastric mucosal glandular ducts, microvascular structural clarity, and lesion contour scoring data from conventional gastroscopy were lower than those from NBI ($P < 0.05$), as shown in **Table 1**.

Table 1. Comparison of gastric structural clarity (mean ± SD, score)

Group	Structural clarity of the gastric mucosal glandular ducts	Clarity of microvascular structure	Lesion outline
Conventional gastroscopy	2.14 ± 0.53	2.37 ± 0.55	2.44 ± 0.41
Narrow-band imaging	3.35 ± 0.65	3.09 ± 0.61	3.12 ± 0.54
t	25.484	15.484	17.715
P	0.000	0.000	0.000

3.2. Screening results

Among the 312 patients, the screening rate of pathologic biopsy was 18.59% (58 cases). Conventional gastroscopy showed a screening rate of 11.53% (36 cases), while NBI technology demonstrated a screening rate of 17.63% (55 cases). However, there was no statistical significance in the two-by-two comparison of the screening rate data ($P > 0.05$). Refer to **Table 2**.

Table 2. Screening results (*n*)

Inspection items		Gold standard (pathology biopsy)		Total
		Positive	Negative	
Conventional gastroscopy	Positive	36	20	56
	Negative	22	234	256
	Total	58	254	312
Narrow-band imaging	Positive	55	2	57
	Negative	3	252	255
	Total	58	254	312

3.3. Diagnostic efficacy

Table 3 shows that the data related to sensitivity, specificity, accuracy, positive predictive value, and negative predictive value of conventional gastroscopy appeared to be lower than those of NBI ($P < 0.05$).

Table 3. Diagnostic efficacy [% (*n*)]

Group	Sensitivity	Specificity	Accuracy	Positive predictive value	Negative predictive value
Conventional gastroscopy	62.09 (36/58)	92.13 (234/254)	86.54 (270/312)	64.29 (36/56)	91.41 (234/256)
Narrow-band imaging	94.83 (55/58)	99.21 (252/254)	98.40 (307/312)	96.49 (55/57)	98.82 (252/255)
χ^2	31.713	6.050	10.101	32.885	5.909
P	0.000	0.014	0.001	0.000	0.015

4. Discussion

Gastric cancer, a malignant tumor arising in the gastric mucosa, is a prevalent cancer worldwide [10]. According to the World Health Organization, it is the fifth most common cancer and the third leading cause of cancer-related deaths globally [11]. The incidence of gastric cancer varies significantly across regions, with a notably high occurrence in Asian regions such as China, Japan, and Korea. Early symptoms are often subtle and inconspicuous, posing challenges to early diagnosis. Common symptoms including dyspepsia, bloating, stomach discomfort, and lethargy, may be similar to other gastrointestinal disorders, leading to oversight [12]. Therefore, effective diagnosis methods are imperative.

Gastroscopy, a common clinical procedure, facilitates the observation and examination of the internal condition of the digestive system. It has emerged as a preferred method for diagnosing and treating digestive diseases and plays a crucial role in follow-up and disease monitoring, such as assessing the therapeutic effects of *Helicobacter pylori* infection and preventive treatment of esophageal varicose vein disease [13]. Endoscopic NBI, enhancing the visualization of submucosal blood vessels by adjusting the color and intensity of the endoscopic light source, improves the detection rate of early gastrointestinal cancer, polyps, and other lesions. This technique aids in evaluating infiltration depth and vascular structure, guiding treatment strategy decisions. It also enhances biopsy precision, increasing sample validity and reducing missed diagnosis rates [14]. Gastrointestinal endoscopy technology and endoscopic NBI contribute significantly to the diagnosis, treatment, and follow-up monitoring of gastric cancer. Their evolving application provides clinicians with more information and options, improving early disease detection and treatment efficacy [15].

The findings of this study indicate lower structural clarity scores in conventional gastroscopy for the gastric mucosa glandular tube, microvascular structure, and lesion contour when compared to NBI. However, the data reveal no statistically significant differences in the screening rate among pathology biopsy, conventional gastroscopy, and NBI. The sensitivity, specificity, accuracy, positive predictive value, and negative predictive value of conventional gastroscopy are lower than those of NBI. Endoscopic NBI demonstrates superiority over conventional gastroscopy.

In conclusion, for early gastric cancer screening, endoscopic NBI technology offers clearer visualization of the gastric mucosal glandular structure and microvascular structure compared to conventional gastroscopy. It boasts a certain screening rate, high sensitivity, specificity, accuracy, positive predictive value, and negative predictive value, making it an outstanding choice for effective early detection and diagnosis of gastric cancer.

Disclosure statement

The author declares no conflict of interest.

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