RESEARCH ARTICLE

Strategies to prevent tumor pathological conditions in the context of mega data

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Tumor issue has always been a hot topic in the medical field, which is related to people's health and brings huge burden of disease. Currently, there is still no effective measures to prevent tumor occurrence. However, early detection of tumor following by prompt treatment can significantly increase the patient's five-year survival rate. In recent decades, the rapid advance of medical sciences and technologies makes it possible for tumor early detection. This research employed gastrointestinal neuroendocrine tumors (GI-NENs) as the study model to investigate the relationships between patients' gender, age, and tumor location, and further, the tumor pathological characteristics and effective detection technologies by using mega data analysis techniques and algorithms to determine the strategies for tumor prevention and early detection. The results showed that there were significant differences between patients' gender, age, and tumor location. Among four popular tumor detection technologies, ordinary digestive endoscopy and endoscopic ultrasound combined with biopsy were the top choices for GI-NENs detection. However, the detection rate was associated with the locations of tumor. By applying mega data analysis techniques in this study, the pathological features of model tumor were analyzed and the potential strategies for tumor prevention and early screening measures were suggested.

Keywords: mega data; gastrointestinal neuroendocrine tumors; endoscopy; biopsy; pathological features.

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Introduction

With the increase in the incidence of tumors in recent years, people are increasingly worried about the life safety or the threat of tumor development. However, the probability of early tumor detection is lower in the areas that are economically underdeveloped in China than that in the developed areas, which may be related to the factors such as people's awareness of regular physical examinations and poor medical environment. In addition, the registration procedures of diagnosed tumors in those underdeveloped areas started later than that in the developed areas with certain underreporting incidence. The application of mega data for tumor prediction is particularly important in these underdeveloped areas in China.

Currently, the tumor treatment methods include surgery (tumor resection) [1-3], chemotherapy (drug therapy) [4-7], radiotherapy (external and internal radiation), traditional Chinese medicine [8-10], and immunotherapy [11-13], which will be determined by physicians according to patients' conditions and tumor sites. it is important to apply the different treatment methods and plans flexibly on individual bases. Although there are many different selections for tumor treatment, the key factor to promote

patient's five-year survival rate is the early detection and early diagnosis. Many studies have focused on the strategies of tumor prevention in the context of mega data and have achieved significant results [14, 15]. Although there are many related studies on strategies to prevent tumor pathogenesis in the context of mega data, tumors still plague people's healthy lives. The discovery of effective ways to prevent tumors is the main issue that needs to be solved urgently. For the tumor prevention, the potential causes of the tumor including daily lifestyle and personal habits and the appropriate detection methods are the keys to achieve the preventive effect [16-17]. This study employed gastrointestinal neuroendocrine neoplasms (GI-NENs), a type of malignant tumor that can occur in any part of the digestive tract, as a study model to analyze tumor pathological characteristics and effective detection technologies by using mega data analysis techniques and algorithms to determine the strategies for tumor prevention and early detection.

Materials and methods

Data resources and collection

Total 170 cases including 97 males with the average age of 54.23 and 73 females with the average age of 46.19 were included in this study. All patients were diagnosed and pathological confirmed of gastrointestinal neuroendocrine neoplasms in the university affiliated hospital (Shangrao, Jiangxi, China) from 2015 to 2020. The data were collected from the tumor registration system of city's Center for Disease Control and Prevention (Shangrao, Jiangxi, China). The tumor registration included all medical information with tumor reporting authority within city. Tumor classification was performed by using the International Classification of Oncology (ICD-10). The population data was retrieved from city public security bureau. The standardized population rate in China (referred as the bid-winning rate) was adopted by using the standard population age composition of the 2010 China national census.

Data quality control

According to "Guidebook for Cancer Registration in China" with the referring to the guidelines of the International Association for Cancer Registries (IACR) (uia.org/s/or/en/1100008251), the comprehensive data review and evaluation of the integrity and validity of the registration data were carried out.

Data analysis and statistics

Network module mining algorithm based on rough fuzzy sets was employed to evaluate the clustering algorithm and the similarity between the prediction module and the reference module [18]. The following formula were applied in this study as the algorithm basis for tumor data clustering, and then, as the key formula for subsequent data analysis.

$$G(x,y)=\begin{cases}P(x)+P(y)-P(x,y)\\(P(x)+P(y))/2\end{cases}$$

$$P(x,y)=P(x)+P(y\mid x)$$

The data were analyzed by using SPSS 26.0 (IBM, Armonk, New York, USA) and Microsoft Excel (Microsoft, Redmond, Washington, USA). The data were subjected to independent sample t-test. The statistically significant was determined when $P < 0.05$ to analyze the relevant data and determine the strategy for tumor prevention.

Results and discussion

Patients' data

The numbers of patients with gastrointestinal neuroendocrine neoplasms (GI-NENs) in each individual year were shown in Figure 1. The tumor incident numbers demonstrated an increased trend through the time. The largest number of GI-NENs patients (43 cases) in this particular hospital was shown in 2019, while the smallest number of patients (13 cases) was found in 2015. In addition, the largest number of male patients (28 cases) was in 2020, while the largest number of female patients (24) was in 2019.

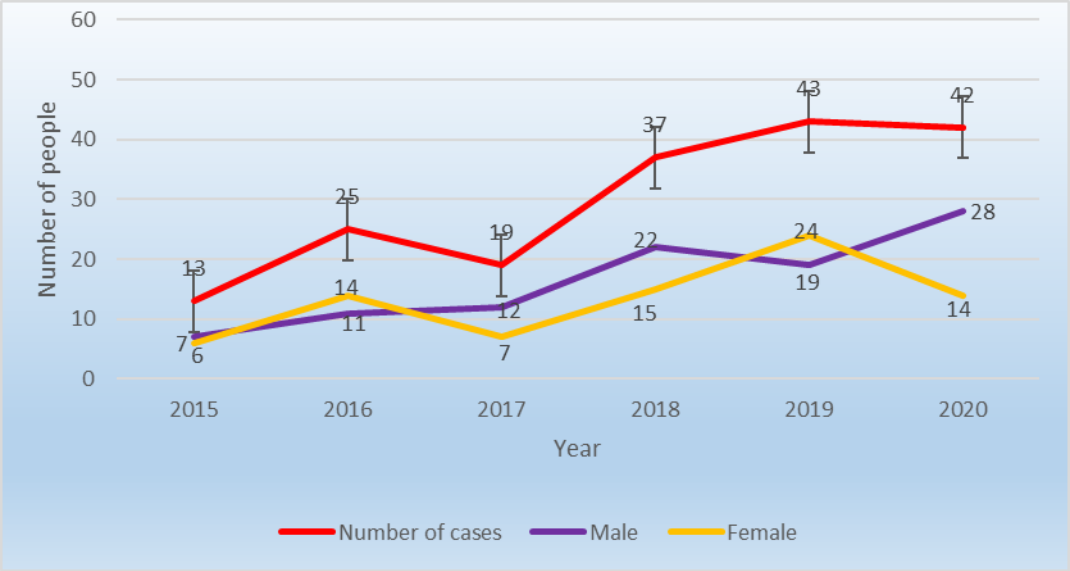

Figure 1. The distribution trend of the number of patients.

Table 1. The gender distribution of GI-NENs in different sections of the digestive tract.

	Esophagus	Stomach	Duodenum	Small intestine	The large intestine	Total
Male	5	12	11	2	67	97
Female	2	5	10	2	54	73
Total	7	17	21	4	121	170

Table 2. The age distribution of GI-NENs in different locations of the digestive tract.

	20-35 years old	36-50 years old	51-65 years old	66-80 years old	81-95 years old	Total
Esophagus	1	2	3	2	2	10
Stomach	3	3	9	6	1	22
Duodenum	2	5	8	7	3	25
Small intestine	1	1	2	3	1	8
Colon	4	3	5	2	2	16
Rectum	13	25	33	22	14	107
Total	24	39	60	42	23	188

The relationship between patient's gender, age and tumor location

Table 1 demonstrated the relationship between patient's gender and the tumor locations. There were 97 male patients (57.06%) and 73 female patients (42.94%). Among them, the subtotal of 7 (4.12%), 17 (10%), 21 (12.35%), 4 (2.35%), and 121 (71.18%) cases with tumors presented in esophagus, stomach, duodenum, small intestine, and large intestine, respectively. The large intestine was the location with the most tumor presented, while the small intestine was the least tumor presented location in both genders. Esophagus, stomach, and large intestine were the higher tumor incident sites in male patients than that of female patients. Table 2 showed that the youngest onset age was 20 years old, and the number of patients between 51-65 years old was

Table 3. Comparison of detection rates for various diagnostic methods.

	No. of patient	No. of detection	No. of no detection	Detection rate
Endoscope	163	159	4	98.82%
CT	49	34	15	71.23%
Ultrasound	26	7	19	25.16%
EUS	143	137	6	97.17%

Table 4. Pathological findings under the endoscopy.

Location	Pathological findings	Number of patients	Detection rate (%)
Esophagus	Ulcer changes or bulges	5	46.97
Stomach	Mucosal bulge	7	53.06
	Malignant ulcer	10	59.93
Duodenum	Digital polyp	11	14.88
	ulcer	4	24.91
	Lumps	4	99.96
Small intestine	Intestinal neoplasms	5	22.02
The large intestine	Intestinal neoplasia	25	77.95
	Mucosal bulge	97	99.98

the largest group accounting for 31.91% of total cases. In addition, rectum was the most popular site for GI-NENs development through all age groups comparing to the other sites in the digestive tract. A significant age difference with the average age of male patients older than that of females was observed ($P = 0.01$) indicating that female might be susceptible to GI-NENs in early ages. Further, the average age of upper digestive tract GI-NENs was about 59.02 years old while the average age of lower digestive tract GI-NENs was about 46.42 years old ($P < 0.01$) indicating that lower digestive tract was easier to develop GI-NENs in the younger age than that in upper gastrointestinal tract.

Comparison of detection rates among different diagnostic technologies

The tumor detection rates of various diagnostic methods were shown in Table 3. Total 159 patients went through ordinary digestive endoscopy with the detection rate of 98.82%. 49 patients received computed tomography (CT) with the detection rate of 71.23%. Only 26 patients went through simple ultrasound examination with the detection rate of 25.16%, while 143 patients received endoscopic ultrasound (EUS) with the tumor detection rate of 97.17%. By comparing the tumor detection rates of above mentioned four diagnostic technologies, ordinary digestive endoscopy or EUS were the top choice for the diagnosis of suspected gastrointestinal neuroendocrine tumors. Total 168 patients who received ordinary digestive endoscopy and/or EUS had biopsies. The pathological findings were shown in Table 4 and the detection rate of each pathological finding was calculated. The results demonstrated that endoscopic biopsy with the following pathological diagnosis was useful for gastrointestinal neoplasm detection. However, the pathological detection rates were various in the different sections along the gastrointestinal tract with the higher detection rates on both upper gastrointestinal tract (esophagus, stomach, duodenum) and the large intestine and rectum sections than that in the small intestine.

Strategies for tumor prevention

Tumor development involves both exogenous and endogenous factors, which include inhalation of haze or smoking and accidently intaking of chemical substances or carcinogens during daily life and/or some special occupations

as exogenous factors, and long-term inflammation and infection [19] as endogenous factors. The best preventive method to the exogenous factors is to avoid the direct contact with such factors. If it is impossible to avoid such factors, some physical preventive measures such as wearing masks and routine tumor screening tests should be under consideration [20]. For patients with existed underline chronic diseases, the regular corresponding tumor screening technologies are suggested for potential tumor early detection. For examples, chronic obstructive pulmonary disease (COPD) patients are recommended to take the regular chest CT screening [21], patients with high breast cancer risks are suggested periodic breast ultrasound and/or mammography [22]. Early detection followed by early intervention will prevent the continued progression of the tumor and significantly increase the patients' five-year survival rate [23]. For the patients with family cancer history and high inheritance risks, routine tumor screening should be given as early as possible [24].

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