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Impact of gender and age on the occurrence of gastric polyps: data analysis of 69575 southeastern Chinese patients

STOMACH

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ABSTRACT

Background/Aims: Current epidemiological data suggest that the incidence of gastric polyps (GP) is rare, and its etiology and pathogenesis are still not clear. This study analyzed and compared the occurrence and pathological types of GPs in southeast Chinese patients according to gender and age.

Materials and Methods: This was a retrospective study of patients diagnosed with GP (n=2125) in Wenzhou People's Hospital (China) between January 2004 and December 2013. The relationships between the detection rate, the characteristics of GP, and the patients' demographic data were analyzed.

Results: The detection rate of GP was 2.3% and 3.9% in males and females, respectively ($p<0.01$). The detection rate increased with increasing age in both genders. Polyps in the gastric antrum and gastric body were the most prevalent in both genders. Similarly, inflammatory polyps and hyperplastic polyps were the most prevalent in both genders. Hyperplastic polyps were more common in females than in males (28.6% vs. 24.2%, $p<0.05$), while there was no difference for inflammatory polyps, fundic GP, and adenoma ($p>0.05$). Age had no impact on the pathology of GP ($p>0.05$).

Conclusions: The incidence of GPs was associated with gender and age.

Keywords: Gastric polyps, gender, age, China, incidence

INTRODUCTION

Gastric polyps (GPs) refer to hyperplastic polypoid lesions of epithelial and/or stromal cells of the gastric mucosa. GPs are considered to be precancerous diseases of gastric cancer (1). The clinical manifestations of GPs are nonspecific, with the majority of polyps occasionally found during gastroscopy examination. Current epidemiological data suggest that the incidence of GPs is rare, and its etiology and pathogenesis are still unclear. It has been reported that the incidence of GPs was more common in females than in males, with a ratio of 1:1.8 to 2.5 (2-6). Moreover, it has been reported that the detection rate of GPs increases with increasing age (7,8). Understanding the occurrence of different types of GPs is important because gastric adenomatous polyps have a high malignancy potential (9), and a small number of hyperplastic polyps are cancerous (10,11). However, no studies documenting a comparative analysis of the types of GPs in different age groups have been reported in China and other counties. To further understand the onset characteristics and patterns of GPs in patients of different genders and ages, a retrospective analysis of the clinical data of patients with GPs in the past 10 years was performed. The detection rate of GPs, endoscopic manifestations, and pathological features in patients with different genders and ages were compared. This study should provide more information about the GP spectrum in southeast China and the incidence of those polyps that are more likely to develop into gastric cancer.

MATERIALS AND METHODS

Patients

In this retrospective study, patients (n=69575; 36447 males and 33128 females) who underwent gastroscopy exami-

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nation because of gastrointestinal symptoms such as abdominal pain, abdominal distention, sour regurgitation, and belching or health examination in Wenzhou People's Hospital (China) between January 2004 and December 2013 were screened.

The patients' demographical information (gender and age) was recorded. Patients (n=2125) who were diagnosed with common types of GPs were evaluated. Analysis of the data, including location of polyps, pathological type, and the presence of *Helicobacter pylori* (Hp) infection, was performed. This study of GPs did not include raised erosive antrum. Before endoscopic examination, 1771 patients (83.3%) had gastrointestinal symptoms, whereas 354 patients had no symptoms (16.7%). The common symptoms were epigastric distention (n=792, 37.3%), epigastric pain (n=625, 29.4%), belch (n=523, 24.6%), sour regurgitation (n=440, 20.7%), and nausea (n=285, 13.4%). This study was approved by the Ethics Committee of Wenzhou People's Hospital, China. Written informed consent for endoscopic biopsy or polypectomy was provided by all studied patients.

GP detection

Instruments used included an Olympus-260 endoscope (Olympus Company; Tokyo, Japan), a high frequency electrical generator (Olympus Company; Tokyo, Japan), biopsy forceps (Olympus Company; Tokyo, Japan), a coagulation cutting snare (Olympus Company; Tokyo, Japan), and foreign body forceps (Olympus Company; Tokyo, Japan). An endoscopic physician conducted examinations of the esophagus, stomach fundus, gastric body, gastric antrum, and duodenum of the patients to observe the size, shape, number, and location of the GPs. The results were then confirmed by a senior physician. If the opinions from these two physicians were not consistent, another senior physician would make the judgement or the judgement was finally determined by a majority of physicians. A total of 2053 patients with GPs (96.6 %) underwent biopsy (n=1577) or extirpation (n=476), followed by pathological examination. If there were multiple polyps, several representative polyps were selected for pathological examinations. The paraffin-embedded tissue sections were analyzed for pathological types according to Rosai and Ackerman's Surgical Pathology standards (Version 9) (12). The silver nitrate method was used to check for Hp infection. The films were examined and classified by two experienced pathologists.

Statistical analysis

All statistical analyses were performed using the Statistical Package for the Social Sciences (SPSS) Software, version 17.0 (IBM; New York, USA). The χ^2 test was used to compare percentage differences between groups, and values of $p<0.05$ were considered statistically significant.

RESULTS

Detection rate of GPs in different gender and age groups

Among 69575 patients who underwent gastroscopy, 2125 patients were found to have common types of GPs, with a detection rate of 3.1%. Among these patients, 848 were males (aged between 15 and 90 years, with a mean age of 55.75±15.22 years) and 1277 were females (aged between 16 and 85 years, with a mean age of 55.17±13.51 years), with respective detection rates of 2.3% and 3.9% (statistically significant, $p<0.05$).

Patients were stratified into four different groups based on age: <20, 20–39, 40–59, and ≥60 years. In the age group of <20 years, the detection rate of GPs was 1.2% (9/724) in males and 2.4% (14/578) in females, with no statistically significant difference between these two groups ($p>0.05$). Among the different age groups in males and females (<20 years, 20–39 years, 40–59 years, and ≥60 years), the detection rates of GPs had significant differences ($\chi^2=78.223$, $p=0.0007$ and $\chi^2=170.737$, $p=0.0009$, respectively). In the age group of <40 years, the detection rate of GPs had no significant difference between males and females, whereas in the age group of ≥40 years, the detection rate of GPs increased with increasing age (Table 1).

GPs distribution in different gender and age groups

The distribution of different types of polyps among male and female patients included cardiac polyps, fundic polyps, gastric body polyps, gastric angular polyps, gastric antrum polyps, pyloric canal polyps, and multiple polyps. There were significant differences between male and female patients in the incidence of gastric body, gastric angular, gastric antrum, and pyloric canal GPs ($p<0.05$), whereas the incidence of cardiac, fundic, and multiple site GPs were not significant between male and female patients ($p>0.05$) (Table 2). Among the different age groups, there were no significant differences in the incidence of cardiac, fundic, gastric body, gastric angular, and gastric antrum GPs, whereas significant differences were observed in the incidence of pyloric canal and multiple site GPs ($p<0.05$) (Table 3).

Pathological type of GPs in different gender groups

Among 2125 patients with GPs, tissue samples from 2053 patients were screened for pathological examination. The various GP types included inflammatory, hyperplastic fundic gland, adenoma, hamartoma, and juvenile, among which there were nine cancerous polyps, originating from the ma-

Table 1. Detection rate of gastric polyps in different gender and age groups

	Detection rate (n/m)			
Age (years)	**Male**	**Female**	**χ^2**	**p**
<20	1.2% (9/724)	2.4% (14/578)	2.575	0.109
20–39	1.5% (171/11753)	2.1% (228/10847)	13.676	0.0002
40–59	2.6% (435/16974)	4.4% (702/16113)	80.173	0.0003
≥60	3.3% (233/6996)	6.0% (333/5590)	49.913	0.0002
p	78.223	170.737		
p	0.0007	0.0009		
Total	1.9% (848/36447)	3.9% (1277/33128)	136.855	0.0001

n: number of subjects with gastric polyps detected, m: total number of subjects.

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lignant transformation of adenomatous polyps. There were significant differences between male and female patients with hyperplastic GPs, which were more common in females, and cancerous GPs, which were more common in males (each p<0.05). On the other hand, there were no significant differences between male and female patients with inflammatory, gastric fundic, adenoma, hamartoma, and juvenile polyps (p>0.05) (Table 4). Among the different age groups, the pathological type of the GPs had no significant difference (p>0.05), while the malignancy rates of the GPs had significant differences (p<0.05) (Table 5).

Relationship between the pathological type of GPs and Hp infection

As illustrated in Table 6, a total of 1483 patients with GPs underwent Hp examination; among these, 626 patients had Hp infection. There were significant differences between Hp infection rate and different polyp types (χ^2=49.007, p=0.0001). The Hp infection rate was significantly higher in patients with inflammatory and hyperplastic polyps than in those with fundic gland and adenomatous polyps. There were significant differences in Hp infection rates between inflammatory and hyperplastic polyps (χ^2=4.556, p=0.033), inflammatory and fundic gland polyps (χ^2=41.003, p=0.0002), inflammatory and adenomatous polyps (χ^2=8.252, p=0.004), hyperplastic and fundic gland polyps (χ^2=28.632, p=0.0009), and hyperplastic and adenomatous polyps (χ^2=5.079, p=0.024).

Table 2. Comparison of gastric polyp distribution in different gender groups [numbers of patients (rate, %)]

Gastric polyp location	Male	Female	χ2	p
Cardia	126 (14.9)	163 (12.8)	1.902	0.168
Fundus	132 (15.6)	240 (18.8)	3.677	0.055
Gastric body	172 (20.3)	374 (29.3)	21.641	0.0003
Gastric angular	31 (3.7)	23 (1.8)	7.077	0.008
Gastric antrum	358 (42.2)	423 (33.1)	18.124	0.002
Pyloric canal	5 (0.6)	23 (1.8)	5.752	0.016
Multiple	24 (2.8)	31 (2.4)	0.328	0.567

GP trends in the last 10 years in different gender and age groups

As listed in Table 7, the detection rate of GPs between 2009 and 2013 was significantly higher than that between 2004 and 2008, both in males and females. The detection rate of GPs in the age group of <40 years did not significantly increase during 2009–2013, whereas it significantly increased in the age group of ≥40 years. When comparing the histological type of GPs, the detection rates of hypertrophic and fundic gland polyps were significantly higher from 2009 to 2013 than from 2004 to 2008, whereas the detection rate of inflammatory polyps declined from 2009 to 2013 compared to 2004–2008. No obvious change in the trend of adenomatous polyps was observed over the years (Table 8). There were significant differences in the detection rates of inflammatory polyps, hypertrophic polyps, and fundic gland polyps in male patients between 2004–2008 and 2009–2013, whereas no significant differences were observed in the detection rate of adenomatous polyps between 2004–2008 and 2009–2013. A similar trend was detected in female patients between 2004–2008 and 2009–2013.

DISCUSSION

GPs are benign protuberant lesions of the gastric mucosa. They generally occur because of the proliferation of epithelial cells, stromal cells, and other collagen elements. It has been confirmed that gastric adenomatous polyps have a higher rate of malignancy potential (9). Studies have also shown that a small number of hyperplastic polyps are cancerous (10,11). Thus, the diagnosis and treatment of GPs should become important in this decade. Currently, the etiology and pathogenesis of GPs are unclear, and only a few epidemiological data of the exact incidence have been reported.

Previous investigations in China showed that the detection rate of GPs was 2 to 3% (1). In the present study, among 69575 patients who underwent gastroscopy, 2125 patients were found to have GPs. The overall detection rate was 3.1%, which is in accordance with previous study results. It has been reported that the incidence of GPs is more common in females than in males, with a ratio of 1:1.8 to 2.5 (2-4). In the present study, the detection rates of GPs were 2.3% and 3.9% in males and females, re-

Table 3. Comparison of gastric polyp distribution in different age groups [numbers of patients (rate, %)]

	Age (years)					
Gastric polyp location	<20	20–39	40–59	≥60	χ2	p
Cardia	2 (8.7)	47 (13.9)	156 (13.7)	84 (14.8)	0.949	0.814
Fundus	7 (30.4)	69 (17.3)	190 (16.7)	106 (18.7)	3.758	0.289
Gastric body	3 (13.0)	85 (21.3)	307 (27.0)	151 (26.7)	7.261	0.064
Gastric angular	2 (8.7)	12 (3.0)	32 (2.8)	8 (1.4)	7.117	0.068
Gastric antrum	9 (39.1)	168 (42.1)	415 (36.5)	189 (33.4)	7.755	0.051
Pyloric canal	0 (0.0)	10 (2.5)	16 (1.4)	2 (0.4)	8.76	0.033
Multiple	0 (0.0)	8 (2.0)	21 (1.8)	26 (4.6)	12.656	0.005

spectively, with a ratio of 1:1.7. It was found that the detection rate of GPs had no significant difference between males and females in the age group of <20 years. This may be because the incidence of GPs was low in this group, and the sample size was not large enough to reveal the relationship between GPs and gender. Meanwhile, in the age group of ≥20 years, the detection rate of GPs was more common in females than in males, and the difference was statistically significant.

Table 4. Pathological type of gastric polyps in different gender groups [numbers of patients (rate, %)]

Pathological type	Male	Female	χ2	p
Inflammatory	566 (69.6)	812 (65.5)	3.084	0.051
Hyperplastic	197 (24.2)	355 (28.6)	4.831	0.028
Fundic gland	30 (3.7)	55 (4.4)	0.688	0.407
Adenoma	19 (2.3)	15 (1.2)	3.832	0.05
Hamartoma	1 (0.1)	2 (0.2)	0.049	0.824
Juvenile	0 (0.0)	1 (0.1)	0.656	0.418
Canceration	7 (0.9)	2 (0.2)	5.508	0.019

The mechanism of this phenomenon is not yet clear because no comparative analysis of GPs in gender groups has been reported in the literature in China and worldwide. Zhu et al. (13) reported that duodenal fluid reflux played an important role in the occurrence of GPs. The refluxed duodenal fluid might cause inflammation hyperplasia of the gastric mucosa, and even further induce adenomas. Meanwhile, a large number of refluxed fluids might elevate the pH value and induce the secretion of gastrin, followed by gastric gland hyperplasia and hyperplastic polyps. It has been reported that duodenal fluid reflux, which may cause gastric mucosal hyperplasia and polyps, is more common in females. In addition, the present study showed that the detection rate of GPs increased with increasing age in males and in females, indicating that older patients are more likely to suffer from GPs, particularly the elderly population. These patients should be considered as key targets for screening.

Table 5. Pathological type of gastric polyps in different age groups [numbers of patients (rate, %)]

	Age (years)					
Pathological type	<20	20–39	40–59	≥60	χ2	p
Inflammatory	20 (87.0)	242 (64.4)	748 (67.3)	368 (67.8)	5.523	0.137
Hyperplastic	3 (13.0)	113 (30.1)	293 (26.4)	143 (26.3)	4.493	0.222
Fundic gland	0 (0.0)	16 (4.3)	48 (4.3)	21 (3.9)	1.199	0.753
Adenoma	0 (0.0)	4 (1.1)	19 (1.7)	11 (2.0)	1.673	0.643
Hamartoma	0 (0.0)	1 (0.3)	2 (0.2)	0 (0.0)	1.286	0.733
Juvenile	0 (0.0)	0 (0.0)	1 (0.2)	0 (0.0)	1.696	0.638
Canceration	0 (0.0)	0 (0.0)	1 (0.1)	8 (1.5)	17.954	0.0004

Note: For the age groups of 40–59 years and ≥60 years, the malignancy rate of gastric polyps χ^2=18.976, p=0.0001

Table 6. *Helicobacter pylori* (Hp) infection rate in gastric polyps with different pathological types [Detection rate (n/m)]

Inflammatory	Hyperplastic	Fundic gland	Adenomatous	χ2	p	Sum
46.4% (438/943)	40.3% (177/439)	8.1% (6/74)	18.5% (5/27)	49.007	0.0001	42.2% (626/1483)

n: number of gastric polyps with Hp infection detected, m: total number of specific types of gastric polyps

Table 7. Trend of the detection rate of gastric polyps [Detection rate (n/m)]

		2004–2008	2009–2013	χ2	p
Gender	Male	2.1% (336/16181)	2.5% (512/20266)	8.013	0.005
	Female	3.1% (443/14087)	4.4% (834/19041)	33.336	0.0008
Age (years)	<20	1.6% (11/688)	2.0% (12/614)	0.236	0.627
	20–39	1.7% (186/10670)	1.8% (213/11930)	0.058	0.81
	40–59	2.9% (392/13521)	3.8% (745/19566)	19.885	0.0008
	≥60	3.5% (190/5389)	5.2% (376/7197)	20.704	0.0005
Sum		2.6% (779/30268)	3.4% (1346/39307)	41.79	0.0001

n: number of subjects with gastric polyps detected, m: total number of subjects

Table 8. Trend of detection rate of gastric polyps with different histological types

	Male				Female				Sum			
	2004–2008	2009–2013	χ2	p	2004–2008	2009–2013	χ2	P	2004–2008	2009–2013	χ2	p
Inflammatory	246	320	15.659	0.0008	307	505	16.279	0.0005	553	825	32.619	0.0001
Hyperplastic	60	137	7.961	0.005	98	257	8.717	0.003	158	394	17.367	0.0003
Fundic gland	2	28	13.682	0.002	7	48	11.487	0.001	9	76	24.685	0.0007
Adenomatous	8	11	0.079	0.778	7	8	1.11	0.292	15	19	1.015	0.314
Hamartoma	1	0	0.39	0.390	1	1	0.68	1.000	2	1	1.08	0.294
Juvenile	0	0			0	1	0.34	1.000	0	1	0.36	1.000

The prevalence of common types of GPs is not the same across different regions of the world. Fundic gland polyps are the most common type in western countries (14). It has been reported that hyperplastic polyps are more common in Turkey. Similarly, in China, the common histological types of GPs are not the same in different studies (15). Zhu et al. (13) reported that the common pathological types of GPs were inflammatory and hyperplastic polyps. However, Cao et al. (2) reported that fundic gland polyps were the most common type of polyps; furthermore, they believed that there was no significant difference in inflammatory and hyperplastic polyps in males and females. A few studies stated that there were differences in the histological types of GPs, where fundic gland polyps were more common in females (1,16,17) and adenoma was more common in males (1). In the present study, the most common type of polyp was an inflammatory gastric polyp; secondary polyps were hyperplastic, fundic gland, and adenomatous polyps, with no gender difference. Hyperplastic polyps were more common in females than in males, whereas there was no difference in the incidence of inflammatory and fundic gland polyps between males and females. Further studies are needed to investigate whether regional differences induce different pathological types. Adenomatous polyps were more common in males than in females; however, the difference was not statistically significant. This may be due to the limited sample size of those diagnosed with adenomatous polyps, which is inadequate for statistical analysis. The cancerous rate of GPs in males was higher in males than in females; this may be because adenomatous polyps are more common in males than in females, and the malignancy of GPs is closely related to adenomatous polyps. In terms of the risk of developing gastric cancer in the current population, further studies would need to be performed on these patients in the future; however, it is fairly well established that adenomas are precursors for gastric adenocarcinoma, and while the risk of gastric cancer from hyperplastic polyps may be less than 2%, it remains worthy of consideration (18). It has been reported that pathological types of polyps differ with different ages (1,8). The proportion of fundic gland polyps in the young group is higher than that in the older group. Meanwhile, the proportions of hyperplastic and adenomatous polyps in the older group were higher than those in the young and middle-aged groups (8). The present study showed that there was no significant difference in the histological type in each age group. The detection rate of adenomatous polyps increased with age; however, the difference was not statistically significant.

In the present study, it was found that Hp infection rates in patients with inflammatory and hyperplastic GPs were significantly higher than in patients with fundic gland polyps and adenomatous polyps, which indicated that Hp infection was associated with the formation of inflammatory and hyperplastic polyps. Hp infection promoted an inflammatory reaction via interleukin-1 and hepatocyte growth factor, leading to the proliferation of gastric epithelial cells and thereby the formation of inflammatory polyps. The results of the present study indicated that the formation of fundic gland polyps and adenomatous polyps had a weak relationship with Hp infection, which was consistent with the results of the previous study (2). Worldwide, it seems that the incidence of Hp infection has an influence upon the types of polyps found in different populations in the west; as Hp infection decreases, fundic gland polyps increase, while in areas such as East Asia, where Hp infection remains common, hyperplastic or neoplastic polyps related to the underlying inflammatory process are more common (18). The level of Hp infection is important because it is an established risk factor for gastric cancer (19), and Hp eradication therapy can effectively reduce the development of precancerous lesions and gastric cancer (20).

The detection rate of GPs increased in males and females during the past 10 years, and it also increased in the age group of ≥40 years. The pathological types of the GPs also changed in the gender groups. The proportion of inflammatory polyps decreased, while the proportion of hyperplastic and fundic gland polyps increased. The proportion of adenomatous polyps showed a small change. In the age group of ≥20 years, the proportion of inflammatory polyps decreased, while the proportion of fundic gland polyps increased significantly. The proportion of adenomatous polyps also showed a small change. In recent years, the incidence of fundic gland polyps increased, which may be related to the widespread use of proton pump inhibitors (21,22).

The present study showed that the predilection sites for GPs were the antrum, gastric body, gastric fundus, cardiac, gastric angular, and pyloric canal. The polyps in the antrum, gastric

body, gastric angular, and pyloric canal differed significantly among genders, while gastric fundus and cardiac polyps did not differ significantly between the genders. Gastric antrum polyps were more common in males than in females, while gastric body polyps were more common in females. Zhu et al. (13) reported that gastric fundus polyps might be related to reflux of the duodenal fluid and was not associated with Hp infection. Therefore, the authors believed that because reflux of the duodenal fluid is more common in females, a higher incidence of gastric body polyps in females was observed. Indeed, further studies are needed to investigate the reason for the differences in the distribution sites of GPs in males and females. In addition, the present study showed that the incidence of GPs in multiple sites increased in older patients of ≥60 years.

In summary, the results of the present study showed that the incidence of GPs was associated with gender and age. The detection rate of GPs was significantly higher in females than in males and increased with age. The distribution and pathological types of GPs were slightly different in males and females. There were differences in the incidence of GPs in the pyloric canal and multiple sites, and there was no significant difference in the pathological types of GPs in different age groups. Hp infection might be related to the incidence of GPs. There was a difference in the incidence of GPs between gender groups, which may be induced by the reflux of the duodenal fluid. Further studies are needed to investigate whether genetic factors, hormones, and other factors may cause differences in GPs between gender groups. The incidence rate of GPs increased with increasing age. The malignancy rate of GPs increased in elderly patients. Particularly, in recent years, the detection rate of GPs has significantly increased in the age group of ≥40 years. Therefore, the elderly population should be treated as the key target for the screening of GPs. Early diagnosis is essential for treatment and prognosis in patients with GPs.

Ethics Committee Approval: Ethics committee approval was received for this study from the ethics committee of Wenzhou People's Hospital, China.

Informed Consent: Written informed consent was obtained from patients who participated in this study.

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