

## Characteristics of upper digestive tract diseases in Bohai Bay fishermen

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Author contributions: All authors contributed equally to the work.

Original title: *China National Journal of New Gastroenterology* (1995-1997) renamed *World Journal of Gastroenterology* (1998-)

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Received: January 28, 1997

Revised: March 22, 1997

Accepted: April 17, 1997

Published online: September 15, 1997

### Abstract

**AIM:** To study the characteristics of upper digestive tract diseases (UDTDs) in fishermen who live in Bohai Bay.

**METHODS:** An investigation was carried out in 1488 fishermen with symptoms of UDTDs (aside from liver, biliary and pancreatic diseases) during the time period between December 1991 and February 1995. This investigation included medical history evaluations, physical, gastroscopic and pathological examinations, tests for *Helicobacter pylori* (*H. pylori*) infection, and analysis of the nitrate content in their drinking water.

**RESULTS:** Among the 1488 subjects investigated, 1467 suffered from one or more of the 14 UDTD diseases, most of which were chronic atrophic gastritis (CAG, 1103 cases), peptic ulcers (268 cases), and cancer of the upper digestive tract (25 cases).

**CONCLUSION:** The incidence rate of UDTDs tends to be high among fishermen due to their particular living habits, the high nitrate content of their drinking water, etc. In addition, the clinical manifestations of UDTDs in fishermen are significantly different from those of the inland residents.

**Key words:** Digestive tract disease; Gastroscopy; nitrate; *Helicobacter pylori*; Gastritis, atrophic; Peptic ulcer; Digestive system neoplasms

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Wang YB, Wang YP, Zou J, Bai BJ, Ren GC, Cai BQ. Characteristics of upper digestive tract diseases in Bohai Bay fishermen. *World J Gastroenterol* 1997; 3(3): 171-173 Available from: URL: <http://www.wjgnet.com/1007-9327/full/v3/i3/171.htm> DOI: <http://dx.doi.org/10.3748/wjg.v3.i3.171>

### INTRODUCTION

Owing to their special living environment and habits, the incidence and clinical manifestations of the UDTDs found in fishermen may be different from those of inland residents. To gain a clear understanding of the characteristics that are specific to the UDTDs in fishermen, an investigation was carried out on fishermen and their family members from a fishing village near Bohai Bay, Qikou town, Hebei Province, from December 1991 to February 1995. These studies will provide important insight into developing improved methods for disease prevention and treatment.

### MATERIALS AND METHODS

#### Subjects

1488 subjects who required medication for the symptoms of upper digestive tract diseases were recruited for the investigation, which accounted for 6.62% of the 22479 individuals in the town (the annual mean population), and 2.08% of the 71479 individuals who had visits to the doctor due to upper digestive tract symptoms over the three years. There were 830 men and 658 women ranging in age from 15 to 78 years who were involved in this study, with 879 patients aged 21-40 years, accounting for 59.07% of the total number of cases. The ratio of men to women was 1.26 to 1. Patients with liver, biliary or pancreatic diseases were excluded from the study. 1430 cases had a detailed record of disease course, which ranged from one month to 30 years, however the majority of cases (1108, 77.48%) covered less than five years. The primary signs and symptoms included slight epigastric pain that was either regular or irregular in 1039 (72.65%) cases, heartburn or acid regurgitation in 801 (56.01%), anorexia in 727 (50.83%), epigastric distension after meals in 563 (39.37%), epigastric tenderness in 883 (61.74%) and other rare symptoms such as belching, nausea and/or vomiting, hematemesis and melena.

#### Methods

A physical examination as well as a detailed inquiry into each patient's medical history was carried out. All patients who were suspected of having liver, biliary or pancreatic disease received liver function tests and B-mode ultrasonographies. 1488 patients without any liver, biliary or pancreatic diseases were enrolled into the study and underwent complete examinations of the esophagus and stomach using GIF-XQ 20 gastroscopy. The gastroscope reached to the duodenal papilla and beyond in 1463 patients, however failed to pass through the obstructed site in 25 patients with cancer. Photographs of recurring phenotypes were taken for 131 cases. Gastritis was diagnosed based on the Criteria and Schemes of Chronic Gastritis by Fibroscopy constructed by the National Seminar on Fibroscopy in 1978. Peptic ulcer, on the other hand, was diagnosed based on the diagnostic and staging criteria proposed by Sakia T, and other diseases were diagnosed based on the corresponding criteria in China. Biopsy specimens were obtained from 503 patients at two to four random sites and

subjected to pathological examination. Subsequent diagnoses were made according to the Pathologic Diagnostic Criteria for Abnormal Gastric Mucosa proposed by the National Conference on Pathology in Zhengzhou in 1978. Investigations into these patient's life habits included smoking history, alcohol consumption, eating habits (consuming very sweet or salty foods), ingesting non-steroid anti-inflammatory agents and eating schedules. The nitrate content of the resident's drinking water was measured by the Tianjin Detection Center for Environment Protection, and the shrimp pastes were cultured for fungus. In the late stage cancers, biopsy specimens were acquired from 171 patients to test for *H. pylori* using the rapid urease test.

## RESULTS

### Gastroscopy

Of the 1488 patients undergoing gastroscopy, 21 showed no obvious signs of abnormalities. The remaining 1467 cases were diagnosed as simple atrophic gastritis (692, 47.17%), simple atrophic gastritis (163, 11.11%), simple bulbar duodenitis (232, 15.82%), peptic ulcer (268, 18.26%), esophagus cardia gastric fundus peptic ulcer cancer (15, 1.02%), gastric cancer (10, 0.68%), or other diseases (87, 5.93%). These non-cancer diagnoses included reflux esophagitis, esophagus and stomach polyps, diverticulum of the esophagus, stomach or duodenum, inflammation of the stomach's cardiac region, achalasia, hiatus hernia, gastrolithiasis, acute gastric mucosal disease, and gastroduodenal ascariasis. Fourteen different diseases types were detected by gastroscopy. There were 1103 (75.18%) cases of CAG found in this study, including 411 cases of atrophic gastritis that accompanied by other diseases, 268 cases of peptic ulcers (including 91 gastric ulcers), 31 pyloric ulcers, 117 duodenal bulbar ulcers and 29 postbulbar ulcers. Among them, 60 patients had complex ulcers, including multiple active gastric ulcers and duodenal ulcers. Kissing ulcers were also seen frequently. In this series, 625 (42.60%) were identified as having two to five different kinds of disease by gastroscopy.

### Pathological examination

Biopsy specimens from 503 cases were pathologically examined; 121 were diagnosed as superficial gastritis, peptic ulcers or cancers of the upper digestive tract, and 382 were identified as atrophic gastritis. The latter included 152 mild (39.79%), 216 moderate (56.54%), and 14 severe (3.66%) cases, with the moderate and severe CAG (230) making up 60.20% of the total cases of atrophic gastritis. Four patients were under 20 years old, of whom one had mild and three had moderate atrophic gastritis.

### Living habits

The medical histories of the 1414 patients revealed that 836 (59.12%) used to smoke 20 cigarettes per day for over one year, 476 (33.66%) drank 150 g or more of spirits per day for over one year, 746 (52.75%) consumed pungent and irritant foods regularly, and 404 (28.57%) drank sugar-water on a frequent basis. All patients ate dried salt fish and shrimp paste almost daily. More than half of the patients had extremely irregular dining habits owing to their sea-based work. Only a small minority of patients ingested non-steroid anti-inflammatory agents. All patients had more than three types of the life-habits specified above. The nitrate content in the drinking water was 400 g/L (the permissible content is less than 250 g/L). Additionally, rugose colony of candida was observed in the shrimp paste cultures.

### Detection of *H. pylori*

One hundred and seventy-one patients tested positive for *H. pylori* using the rapid urease test, of which 112 (65.48%) were positive and 59 negative (34.50%).

## DISCUSSION

UDTDs are common diseases with complicated etiologies, however their incidence rates have not been reported to date. The incidence of UDTs in the population under investigation was as high as

98.59%, however this does not represent the true rates of UDTD detection and incidence in fishermen because they make up only 6.62% of the local population. Nevertheless, our results may suggest a potential high USTD incidence rate among the fishermen in Bohai Bay. The main categories of UDTDs detected in this population included CAG, peptic ulcers, cancer of the esophagus-cardia-gastric fundus and gastric cancer. The manifestations of these three diseases were not in agreement with those previously reported in the Chinese literature. According to the data reported by Li SN, the detection rate of atrophic gastritis was 6.58% in a 15-25 year old group studied and 34.62% in a separate group ages 65 years and older in regions with high incidences of gastric cancer, while 0% and 6.90% rates, respectively, were found in low incidence regions. In comparison, the reported detection rate in China ranged from 3.20% to 34.62%. In this study, the detection rate of CAG was 74.12% using gastroscopy and 75.94% *via* pathological examination, which are markedly higher values than those mentioned above. This suggests that the incidence of CAG was significantly higher in Chinese fishermen than in the inland residents ( $\chi^2 > 6.63$ ,  $P < 0.01$ ). Up until now, there have been no reports on the degree of atrophy in UDTD. Our results show that the mild, moderate and severe atrophies of the gastric mucosa were 39.79%, 56.54% and 3.66%, respectively, in the 382 cases diagnosed by pathological examination. The moderate and severe atrophies, however were increased up to 60.20%. Furthermore, there were three moderate atrophic cases in the four CAG patients below 20 years of age. It is clear that CAG tends to occur in younger individuals and is significantly more severe in fishermen than in inland residents. In addition, rough gastric mucosa with obvious protrusions, pitting, bleeding, erosion, cobblestone-like morphologies and pseudohypertrophy were often seen in fisherman patients with moderate to severe, but rarely found in inland patients. The incidence of peptic ulcers was reported to be 10%<sup>[2]</sup>. Huang XQ and Qian AC<sup>[3]</sup> concluded that approximately 10% of the Chinese population suffered from peptic ulcers, with the ratio of male to female ranging from 2:1 to 7.4:1<sup>[2,4]</sup>. Among peptic ulcers, 70%-80% were duodenal ulcers<sup>[5]</sup>, 17.5%-20% were gastric ulcers, 5% were complex ulcers, and among the duodenal ulcers 5% were postbulbar ulcers<sup>[5]</sup>. In this series of patients, the ratio of men to women was 1.26:1, and there were 43.65% duodenal bulbar ulcers, 19.86% postbulbar ulcers, 33.95% gastric ulcers and 22.38% complex ulcers. In comparison with values reported in the literature, there were relatively higher detection rates of gastric, postbulbar, and complex ulcers and lower detection rates of duodenal bulbar ulcers ( $\chi^2 > 6.63$ ,  $P < 0.01$ ). In addition, pyloric ulcers and multiple ulcers were also more common in fishermen vs inland residents. Notably, both esophageal and gastric carcinomas are common in China. For example, there are 19 counties and towns in China where the standardized mortality rates from esophageal cancer are over 100/100000; the mortality rates of gastric cancer is 20.95/100000 for males and 10.16/100000 for females<sup>[5]</sup>. The fishermen in this study accounted for 1.02% and 0.68% of the male and female population, respectively, therefore suggesting that Qikou Town has a high incidence rate of esophageal and gastric cancers.

The characteristics of UDTDs found in Bohai Bay fishermen could be related to the several factors. Firstly, coastal residents often consume sodium-rich food such as salt fish and shrimp paste. Long-term high sodium intake can lead to increased osmotic pressure in both the stomach and duodenum and stimulate osmotic pressure receptors on the duodenal wall. As a result, gastric emptying time is prolonged leading to the build up of noxious substances from consumed food in the stomach. This increased stimulation to gastric mucosa causes severe injury, ultimately resulting in chronic gastritis. In addition, nitrates in food are often converted to nitrites by the activity of bacterium reductases, which increase gastric cancer risk. Additionally, excessive long-term smoking can stimulate gastric acid secretion, causing incompetence of the pyloric sphincter, reflux of both bile and duodenal juice into the stomach, elevation of pepsinogen levels in serum, decrease of bicarbonate levels in pancreatic juice and a decrease of prostaglandin E2 levels in serum. The increase in aggressive factors and decrease in defensive

factors could lead to injury of the gastric and duodenal mucosa, resulting in inflammation and the generation of peptic ulcers in both the stomach and duodenum. Another possible reason why UDTD incidence is higher in fishermen than in inland residents is the nitrate content of their drinking water, which was almost twice the level set by the state. Long-term ingestion of nitrate-rich water could lead to accumulation of nitrate in the body. Nitrate is a main source of nitrosamine and nitrosylamine, which are both carcinogenic substances. High nitrate content in food may therefore be an important cause of esophageal and gastric cancers. Furthermore, consuming food that is either too hot or too sweet, in addition to drinking spirits, not only enhances aggressive factors that cause injury to gastric mucosa, but also weakens the defensive factors in the stomach, ultimately resulting in an imbalance of the two factors and the onset of gastritis and gastric ulcers.

Most experts believe that *Hp* infection is related to the occurrence and progress of both gastritis and peptic ulcers, however its relationship to gastric cancer requires further study.

The candida in shrimp paste is an opportunistic pathogenetic fungus, but it does not cause damage to the gastric mucosa under normal conditions. However if the gastric internal environment

changes due to the previously mentioned four factors, candida may act as a pathogen by contributing to UDTDs, which were more prevalent in fishermen compared with inland residents.

It has been suggested that the successful prevention and treatment of UDTDs in fishermen depends upon improving both their social environment and living habits, in addition to pharmacotherapy - lowering nitrate content of their drinking water, minimizing salt fish and shrimp paste consumption, giving up smoking and alcohol, and eating foods with minimal irritants.

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S- Editor: Filipodia L- Editor: Jennifer E- Editor: Hu S



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ISSN 1007 - 9327

