CLINICOPATHOLOGIC STUDY OF GASTRIC CARCINOMA WITH DUODENAL INVASION

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Clinicopathologic features of 319 patients who underwent gastrectomy for adenocarcinoma of stomach were studied whether disease involved duodenum or not. Thirty-eight patients (11.9%) had duodenum invasion. Gastric carcinoma with duodenal invasion was most often Borrmann III or Borrmann IV (65.8%) type, with pylorous invasion by endoscopy (39.5%), large tumor size (73.7% ≥ 5cm), lymph node metastasis (78.9%), serosal invasion (97.4%) and the incidence of the resection line not being free was high (13. 2%). Duodenal invasion was most often (55.3%) direct through the deep layer or through lymphatics or venules. We need to pay more attention to finding duodenum invasion. More than 3 cm width of duodenal resection is recommended if duodenum invasion is suspected.

Key words: gastric carcinoma, duodenum invasion

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Carcinoma of the distal stomach bounded by the pylorus so that extension into the duodenum does not occur was first described by Rokitanky[1] in 1861. It has been stated by several investigators[2-6] that transpyloric extension of gastric carcinoma is so rare that a gastric tumor can be considered to be lymphoma or inflammatory disease only if radiographic findings of duodenal invasion is seen. Microscopic invasion of the duodenum by gastric carcinoma was found surprisingly later. Koehler *et al.*[7] found that duodenal invasion was detectable radiographically in 5% of patients with gastric carcinoma but with 18% using histological evidence. Zinninger and Collins[8] stated that microscopic invasion of the duodenum occured as far as 35mm from the edge of the tumor even in macroscopically well-defined gastric lesions. Therefore, gastric carcinoma invasion of the duodenum seems to be more frequent than expected, based on gross findings of the tumor. Here we describe the clinicopathological difference between gastric carcinoma with duodenal involvement and without it.

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MATERIALS AND METHODS

All of the three hundred and nineteen patients with gastric carcinoma who underwent gastrectomy in Kaohsiung Medical College from Jan. 1982 to Dec. 1994 were included in this study. Serial and subserial sections of all resected specimen were performed. We took at least six representative blocks in every case. In some cases we took all the lesion into blocks, especially in early gastric carcinoma. A mean of 25 (subtotal resection) or 45 (extended gastrectomy) lymph nodes were removed to determine the lymph nodes metastases. All resected specimens were examined histologically to ascertain mode and depth of invasion, histologic type, presence of metastasis to lymph nodes, and invasion of the duodenum according to the rules of the Japanese Research Society for Gastric Cancer[9].

Patients were grouped into two sections, according to whether or not there was invasion of duodenum. All available clinical information including the sex, and age of patients, the tumor size and location, Borrmann classification [10], degree of gastric wall invasion, and lymph

node metastasis was gathered. Curative operation was considered when all the carcinoma and the metastatic lymph nodes were removed. Resection specimens were examined carefully to check whether or not they were free of the resection line. Clinicopathologic data were analyzed by chi-square test and Student's t-test between groups.

RESULTS

Of the 319 patients with gastric carcinoma, there was evidence of duodenal invasion in 38 (11.9%). Table 1 shows the clinical characteristics of each group. There was no statistical difference in sex or age between these two groups. The duodenal invasion group had a higher incidence (65.8% vs. 27.0%) of BorrmannIII and IV type (infiltrative type) in gross appearance. The incidence of larger tumor size (≥ 5cm) was found to be more frequent (73.7% vs. 43.1%) in the duodenal invasion group. Also, pylorus invasion by endoscopy was found to be much more frequent (39.5% vs. 13.2%) in the duodenal invasion group. Histological features of each group are shown in Table 1. The duodenal invasion group had a higher incidence (97.4%) of serosal invasion than did the other group (61.6%). In histologic type there was no statistical difference between these two groups.

In the duodenal invasion group, the incidence of metastatic lymph nodes (78.9%) was higher than that of the other group (61.6%). The incidence of resection-line-not-free was found to be 13.2% in the duodenal invasion group and 1.1% in the other group (Table 2). In the most cases, cancer invaded the duodenum through the deep layer (55.3%) or whole

Table 1. Clinicopathologic Characteristics of Patients with or without Duodenal Invasion

	Duodenal invasion		P value*
	Positive	Negative	
Sex			
Male	23 (60.5)	176 (62.6)	NS
Female	15 (39.5)	105 (37.4)	
Age (yr)	59.6±11.5	59.2±11.8	NS
Gross appearence			
Borrmann III, IV	25 (65.8)	76 (27.0)	<0.01
Others	13 (34.2)	205 (73.0)	
Size (cm)			
≥5cm	28 (73.7)	121 (43.1)	<0.01
<5cm	10 (26.3)	160 (56.9)	
Pylorus invasion by endoscopy			
Positive	15 (39.5)	37 (13.2)	<0.01
Negative	13 (34.2)	204 (72.6)	
Unknown	10 (26.3)	40 (14.2)	
Depth of cancer invasion			
Serosa positive	37 (97.4)	173 (61.6)	<0.01
Serosa negative	1 (2.6)	108 (38.4)	
Histologic type			
Differentiated	10 (26.3)	119 (42.3)	NS
Undifferentiated	28 (73.7)	162 (57.7)	
Lymph node metastases			
Positive	30 (78.9)	173 (61.6)	<0.05
Negative	8 (21.1)	108 (38.4)	

NS: not significant
*P value based on chi-square test and t-test

layer (18.4%). Non-continuous intralymphatic or intravenous spreading was also found in 7. 9% and 5.3% respectively (Table 3).

DISCUSSION

Clinically, the border between the stomach and the duodenum is not clear. Although the pyloric ring belongs to gastric tissue macroscopically, Brunner's glands are found in the mucosa just over the pyloric ring. Therefore, it seems appropriate to define the beginning of Brunner's glands as the start of duodenum when discussing duodenal involvement.

Gastric carcinoma with duodenal involvement is not rare in this report; 11.9% of all patients with gastric carcinoma who underwent gastrectomy had duodenal invasion. This is similar to the report by Koehler *et al.*[7] and Isozaki *et al.*[11].

The depth of invasion and lymph node metastasis are the most independent prognostic factors in gastric carcinoma repoted by Maruyama[12]. Duodenal invasion also is an independent prognostic factor for gastric cancer in the antrum reported by Yoshihiro[13]. Gastric cancer with duodenal involvement is most often infiltrative and advanced with serosal invasion or metastases to the lymph node[13]. The association of duodenal involvement with both serosal invasion or lymph nodes metastases is clear in our study (Table 1). Advanced carcinoma reaching the serosa may involve the duodenum, since there was duodenal invasion in 1 (1.2%) of 83 early gastric cancers in our study.

How does the gastric carcinoma involve the duodenum? Zinninger and Collins[8] found that gastric carcinoma involves the duodenum by direct infiltration to the muscle layer or by extension into the subserosal lymphatics. Paramandhan[14] noted that carcinoma invades through duodenal submucosal lymphatics, and Ohhara[15] stated that infiltrative or lymphangitic cancer frequently involves tissue through the duodenal submucosa or deeper layer. We found that cancer often infiltrated directly through the deep layer (55.3%) or intralymphatics (7.9%). This result is similar to the report by Isozaki[11] *et al.* In this study, only 39.5% of patients with duodenal invasion were found to have pylorous invasion from endoscopy in our series. In this, Brunner's glands seem to be a barrier. The pyloric ring is the contact area between two different types of mucosa, but the submucosal and subserosal layer are not interrupted. Thus, cancer may invade contiguously through loose submucosal or subserosal tissue. Although the lymphatics in the mucosa and submucosa of the pyloric region do extend for a short distance into the duodenum, there is no communication between the subserosal lymphatics. This is markedly different from the free communication between the lymphatics of the stomach and lower esophagus. The lack of lymphatic communications between the stomach and duodenum is another feature explaining the mode of dissemination to the duodenum[16,17]. Destruction of the pyloric capillaries making the barrier disappear provides the main route of duodenal invasion as reported by Wang *et al.*[18]. Okamura *et al.*[19] reported a high rate (57%) of esophageal invasion in patients with adenocarcinoma in the upper third of the stomach. Resective-line-not-free was found to be very high (13. 2%) in patients of gastric carcinoma with duodenal invasion at this study. This makes the prognosis very poor. Pancreato-duodenectomy

Table 2. Resection Line of Gastric Carcinoma with or without Duodenal Invasion

	Duodenal invasion		P value*
	Positive	Negative	
Resection line			
Free	33 (86.8)	278 (98.9)	<0.01
Not free	5 (13.2)	3 (1.1)	

*P value based on chi-square test

Table 3. Mode of Duodenal Invasion in Gastric Carcinoma

Mode of invasion (%)			
Continuous		Non-continuous	
Superficial	3 (7.9)	Intralymphatics	3 (7.9)
Expansion	2 (5.3)	Intravenous	2 (5.3)
Deep layer	21 (55.3)		
Whole layer	7 (18.4)		
Total	33 (86.8)		5 (13.2)

may be required for the removal of lymph nodes in patients with gastric cancer who show a severe infiltration into the duodenum[11]. When the tumor is close (<1.5cm) to the pyloric ring, more than 3cm width of duodenal resection is recommended[19].

In the light of these findings, we conclude the following: (1) gastric carcinoma with duodenal invasion is often advanced and infiltrative, with invasion to the serosa; it also had a tendency to involve vessels or metastasize to lymph nodes; (2) it is difficult to find duodenal invasion from endoscopic examination; (3) gastric carcinoma invades the duodenum most often directly through the deep layer or through lymphatics or venules; (4) there is a hgih incidence of resection line not being free.

We need to take much more care to find the duodenal invasion in infiltrative gastric carcinoma involving the antrum. In doing so, appropriate treatment for advanced gastric cancer can be determined.

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胃癌併十二指腸侵犯之臨床病理研究

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319位接受胃手術切除之胃癌病人，我們以臨床病理觀點研究其侵犯十二指腸與否。侵犯十二指腸者38例，佔11.9%。胃癌併十二指腸侵犯之病例在內視鏡檢查下大多屬於Borrmann III or Borrmann IV type，佔65.8%，且39.5%可見侵犯幽門，腫瘤直徑大於5公分者佔73.7%，淋巴轉移佔78.9%，漿膜層侵犯更高達97.4%，並且手術切除不完全者比率達13.2%。胃癌侵犯十二指腸之途徑主要是經由深層或淋巴管、靜脈，佔55.3%。因此，我們必須更留意胃癌侵犯十二指腸情形。若懷疑十二指腸侵犯，切除十二指腸3公分以上是必要的。

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