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Clinical and Pathological Features of Small Intestine Tumors

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Abstract: Small intestinal tumor is a rare disease, with atypical symptoms, difficult for early diagnosis, with Controversial treatment. This study was to provide reference for prevention, diagnosis and treatment of this tumor. 57 cases of small intestinal tumor were reviewed. Clinicopathological features, survival and prognosis were followed up. Rates were compared using chi-square test, means between multiple groups were compared using ANOVA, OS was analyzed by Kaplan–Meier, COX proportional hazard model was for analyzing the prognosis. Number of cases showed increasing trend since 2000. Female exceeded Male except for jejunum tumor, but without significant difference; There were no significant difference between cases of more and less than 60 years of age. Exept for rare pathological types of carcinoid, female exceeded male, but without significant difference. Abdominal pain was the most common main clinical manifestation. 26.3% patients were found during treatment for intestinal obstruction. Jaundice was the manifestation of duodenal tumors, especially located ampulla of Vater. Anal stopping exhaust defecation was main clinical manifestation of ileal tumors. Main clinical symptom of adenocarcinoma was jaundice. Stromal tumor had clinical manifestations of diarrhea. Abdominal pain was primary clinical manifestation of other extremely rare pathological types. Gastrointestinal endoscopy was the most common examinational procedure. In Conclusions, Adenocarcinoma was the most common type among small intestinal tumors. Age had no effect on the choice of operative or chemotherapy option. Gender or age was independent prognostic factors for OS. Surgery was the most effective treatment, role of chemotherapy displayed no survival benefit.

Keywords: Small Intestinal Tumor, Clinicopathological Features, Treatment, Prognosis

1. Introduction

Small intestinal tumor is a kind of rare disease, with atypical clinical manifestations, difficult early for diagnosis, lack of standardized comprehensive treatment program, chemotherapy is still in dispute. Some experts believe that surgical resection is the main treatment [1], but the operation scheme is not perfect. The key to improve the curative effect is early diagnosis and effective treatment. We reviewed clinicopathological features and diagnostic methods of 57 cases from 1995 to 2012, aimed to provide reference for prevention, diagnosis and treatment of this disease.

2. Materials and Methods

The study protocol was approved by Medical Ethics Committee of Southern Medical University. Written informed consent was waived because the study was retrospective in design.

2.1. Data Collection and Follow-up

According to the preliminary search and retrieval of clinical data, a total of 57 patients with small bowel tumors were treated in our hospital from 1995 to 2012. All patients had complete clinicopathological data, of which 47 had complete follow-up data. Inclusion criteria were as follows: definitive pathological diagnosis, complete

clinicopathological data. Patients were followed up through clinical data, consultation with doctors or telephone. OS (overall survival) was from the diagnosis to death or the end of followed-up.

Patients' records/information were anonymized and de-identified prior to analysis. Our research had been performed in accordance with Declaration of Helsinki and approved by Medical Ethics Committee of our country.

2.2. Statistical Analysis

We performed statistical analysis with SPSS 19.0 software, rates compared using chi-square test, means between multiple groups compared using ANOVA, OS analyzed by Kaplan–Meier. Prognosis were analyzed by COX proportional hazard model. Test level α=0.05.

3. Results

3.1. Epidemiological Features

Figure 1 showed cases of small intestinal tumors increased year by year: two cases in 1995–1997 (3.5%), four in 1998–2000(7.0%), 14 in 2001–2003 (24.6%), eight in 2004–2006 (14.0%), 13 in 2007–2009 (22.8%), and 16 in 2010–2012 (28.1%). Only eight patients received chemotherapy, which were all postoperative chemotherapy. The yearly distribution was as follows: one case in 1995–1997(12.5%), none in 1998–2000(0%), two in 2001–2003 (25.0%), two in 2004–2006 (25.0%), one in 2007–2009 (12.5%), and two in 2010–2012 (25.0%) (Figure 1); the percentage of patients received chemotherapy was as follows: 50.0% vs 0% vs 14.3% vs 25.0% vs 7.7% 12.5%.

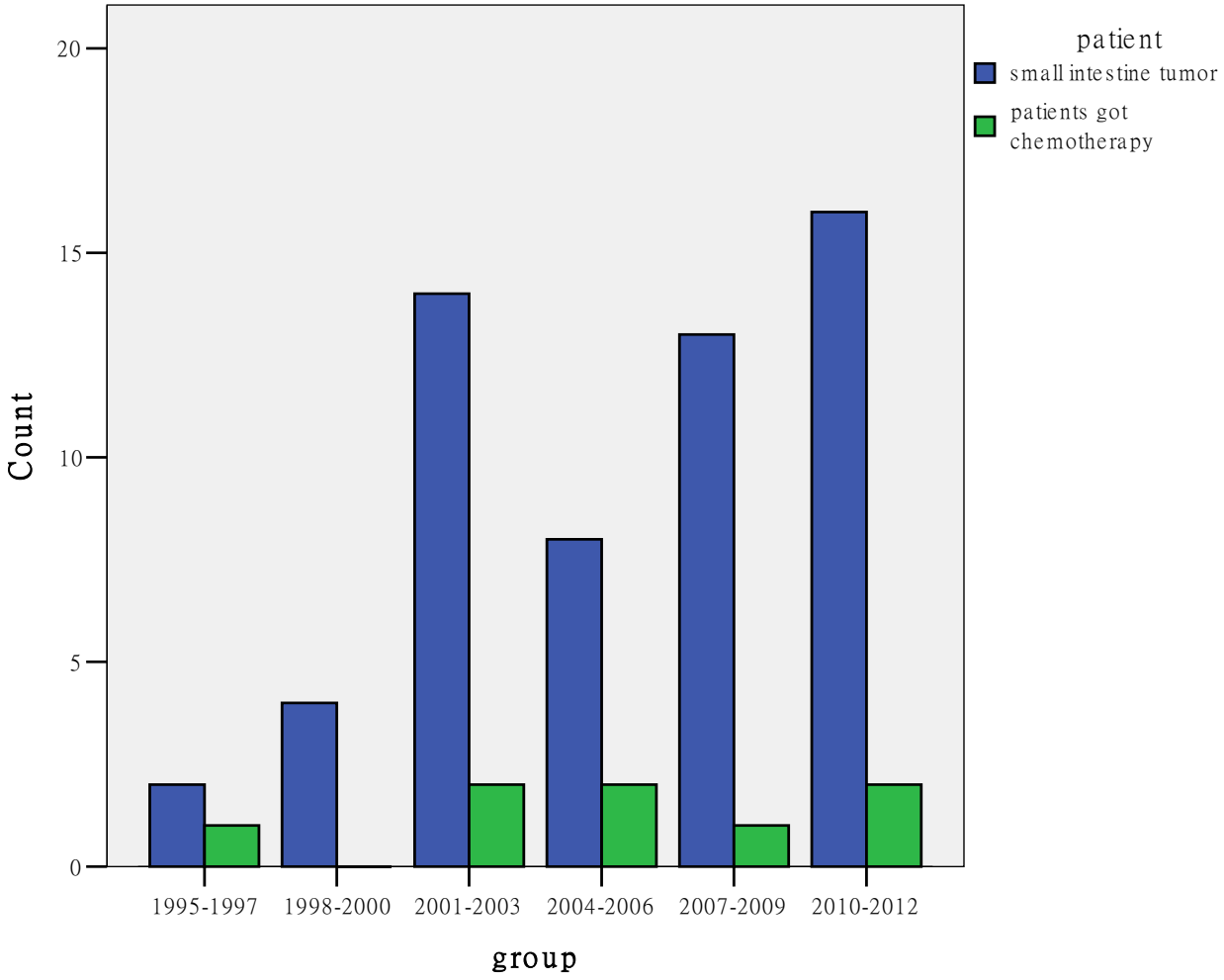

Figure 1. *The number of patients and patients got chemotherapy from 1995 to 2012.*

The cases of small intestinal tumors increased year by year. However, only 8 received chemotherapy, all of which were postoperative chemotherapy.

As shown in Table 1, 27 were males (47.4%) and 30 were females (52.6%); ten patients had smoking history (17.5%), seven patients had drinking history (12.3%) and three patients had family history of cancer (5.3%). The percentage of patients with tumors located in non-ampullary duodenum, jejunum, ileum and duodenal ampulla was 36.8%, 8.8%, 15.8% and 38.6%, respectively. 11 cases (19.3%) survived for more than three years, including five cases of gastrointestinal stromal tumor, five cases of adenocarcinoma and one case of large B cell lymphoma. Female exceeded male with tumors of non-ampullary duodenum, ileum and duodenal ampulla except for jejunum, but difference was not significant (P=0.278). No significant difference existed between more and less than 60 years of age (P=0.944) (Table 4). Adenocarcinoma and stromal tumor had similar age of incidence (P=0.442), but lower

compared with other tumors (P=0.002). Onset age of Other tumors was younger than adenocarcinoma (P=0.002) and stromal tumor (P=0.020). There was no significant correlation between location of the tumor and average age (P >0.05) (Table 2). A total of 50 patients had obvious symptoms before diagnosis (87.7%), common symptoms were abdominal pain (26 cases), jaundice (16 patients), nausea and vomiting (11 cases), and abdominal distension (nine cases). Seven cases were found via physical examination without clinical symptoms.

Table 1. *The clinicopathological features and treatment characteristics of primary small intestinal malignant tumors.*

Clinical and treatment		n	Percentage (%)
Gender	Male	27	47.4
	Famale	30	52.6
Age	<60 years	19	33.3
	⩾60 years	38	66.7
Smoking	No	47	82.5
	Yes	10	17.5
Drinking	No	50	87.7
	Yes	7	12.3
Family tumor history	No	54	94.7
	Yes	3	5.3
Clinical feature	No	7	12.3
	Yes	50	87.7
Treatment	Surgery	31	54.4
Surgery+chemotherapy		8	14.0
Chemotherapy alone		0	0
Supportive therapy		18	31.6
Location	Non-ampullary duodenum	20	35.1
Jejunum		5	8.8
Ileum		8	14.0
Duodenal ampulla		24	42.1
Pathology	Adenocarcinoma	47	82.4
Stromal tumor		7	12.3
other		3	5.3

3.2. Pathological Type

The ratio of male to female was 0.9:1, and the percentage of adenocarcinoma, stromal tumors and tumors was 82.4, 12.3 and 5.3%, respectively. One patient was suffering from caroiniod, one from angioendothelioma, and the other from large B cell lymphoma. Figure 2a-j showed different immunohistochemistry sections of different pathological types: SBA (small bowel adenocarcinoma) and stromal tumors were classified as I, II, III and IV degree. Cases of female were more than these of males in other pathological type except for caroinoid, but with no significant difference (P=0.843) (Table 3). The median age of SBA patients (64.0) was older than that of others except for stromal tumors. The median age of other patients was younger (43.0) than SBA (P=0.002) and stromal tumors (P=0.020), with statistically significant difference (Table 2). Smoking had correlation with pathology especially for SBA (P=0.000), but no correlation with the location of tumors (P=0.386). Drinking had no correlation with pathology and the location of tumors (P> 0.05). There was no significant difference (P=0.633) of the tumor family history among different pathological types.

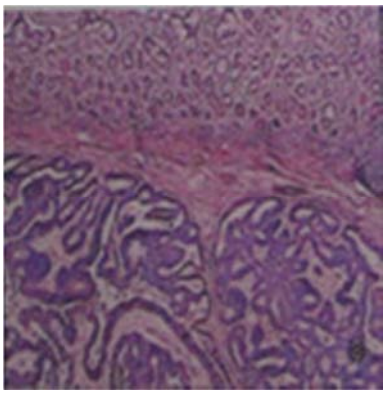

Figure 2a. *Adenocarcinoma I degree.*

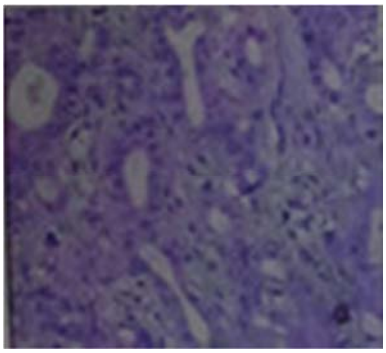

Figure 2b. *Adenocarcinoma II degree.*

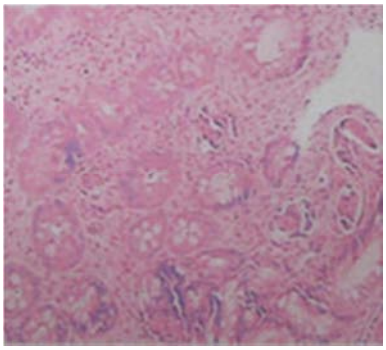

Figure 2c. *Adenocarcinoma III degree.*

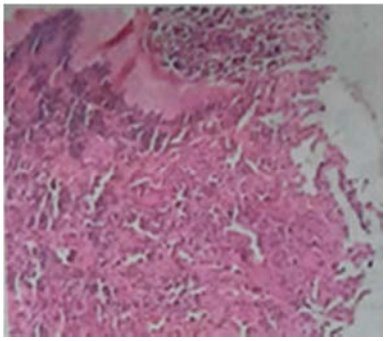

Figure 2d. *Adenocarcinoma IV degree.*

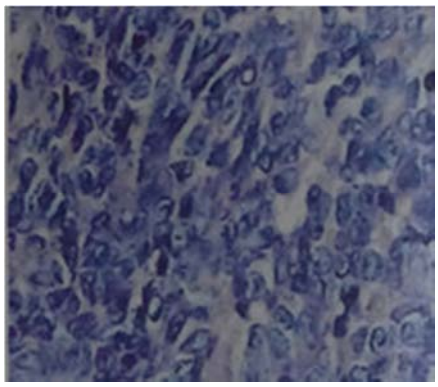

Figure 2e. *Stromal tumors I degree.*

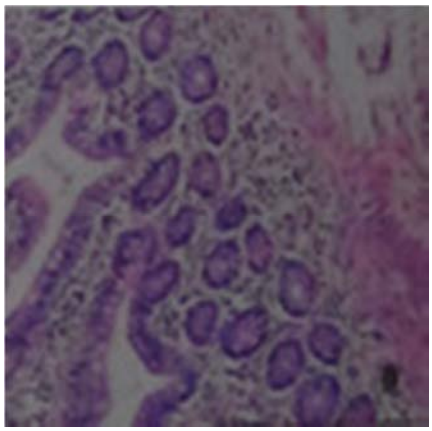

Figure 2f. *Stromal tumors III degree.*

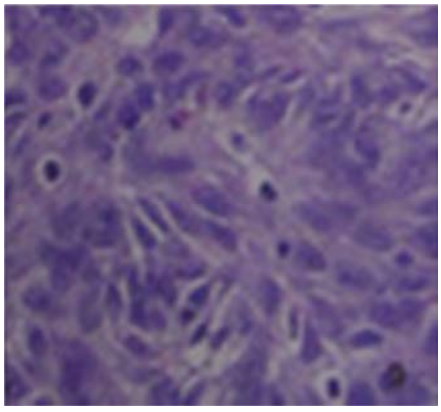

Figure 2g. *Stromal tumors IV degree.*

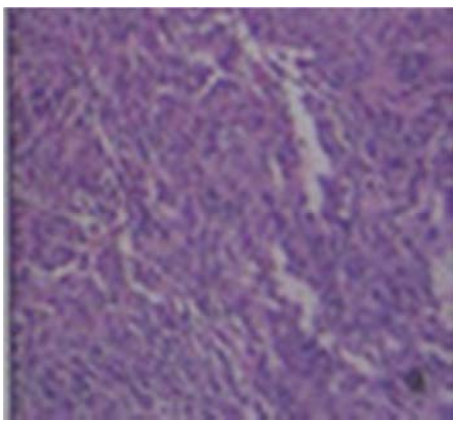

Figure 2h. *Liver metastasis.*

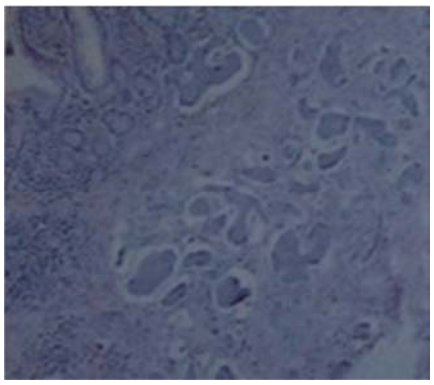

Figure 2i. *Carcinoid.*

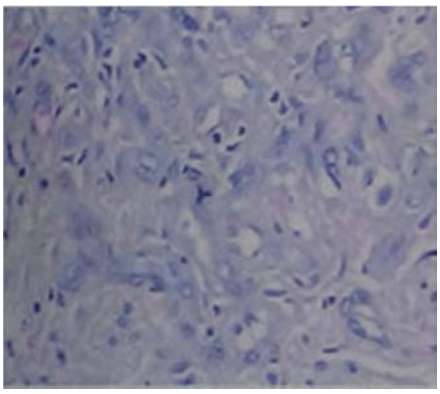

Figure 2j. *Angioendothelioma.*

Figure 2a–2j. *HE staining pictures of different pathological types.*

Table 2. *Relations between age and histological type, tumor location, and treatment.*

	Mean age	**95% CI**	***P***
Pathology			
Adenocarcinoma	68.0±12.3	(64.4, 71.6)	0.442
Stromal	64.0±12.9	(52.1, 75.9)	0.020
other	43.0±18.7	(-3.4, 89.4)	0.002
Location			＞0.05
Non-ampullary duodenum	67.3±16.9	(59.3, 75.2)	
Jejunum	61.8±11.1	(48.0, 75.6)	
Ileum	65.2±11.5	(55.7, 74.8)	
Duodenal ampulla	66.5±12.3	(61.3, 71.7)	
Treatment			＞0.05
Surgery	65.9±11.8	(61.6, 70.3)	
Surgery +chemotherapy	60.2±20.1	(43.4, 77.0)	
Supportive therapy	69.2±13.3	(62.6, 75.8)	

There was a correlation between pathology and the tumor location (P=0.030). Located in the duodenal ampulla were all adenocarcinoma with the largest number (51.1%), followed by non duodenal ampulla cancer more (36.2%). Located in jejunum was mainly stromal tumor (60%) and adenocarcinoma (40%). Stromal tumor locations: Jejunum > ileum > non-ampullary duodenum. Various pathological types can be found in ileum. Other rare pathological types mainly located in ileum (66.7%), followed by non-ampullary duodenum (Table 3).

Table 3. *The analysis between clinical and pathological features.*

	Adenocarcinoma	Stromal	Other	*P*
Gender Male	23	3	1	0.843
Female	24	4	2	
Age ＜60	14	3	2	0.358
⩾60	33	4	1	
Smoking No	35	7	3	0.000
Yes	12	0	0	
Drinking No	38	7	3	0.321
Yes	9	0	0	
Family tumor history No	43	7	3	0.633
Yes	4	0	0	
Clinical features Bellyache	21	2	3	0.077
Jaundice	16	0	0	0.030
Bloating	9	0	0	0.138
Gastrointestinal bleeding	6	1	0	0.637
Nausea, vomiting	10	1	0	0.880
Abdominal mass	1	0	1	0.056
Anorexia	4	0	0	0.349
Acid regurgitation, belching	3	1	0	0.744
Anal stop exhaust defecation	6	0	0	0.242
Diarrhea	0	1	0	0.020
Other	5	3	0	0.023
No obvious features	6	1	0	0.129
Location Non-ampullary duodenum	17	2	1	0.030
Jejunum	2	3	0	
Ileum	4	2	2	
Duodenal ampulla	24	0	0	

3.3. First-Choice Examination and Diagnosis

As shown in Figure 3, after obvious clinical features, the first choice of examination was endoscopy of digestive tract (31.0%), followed by CT (computed tomography, 27.4%), gastrointestinal radiography (13.3%), ultrasound (12.4%), MR (magnetic resonance, 6.2%) and MRCP (magnetic resonance cholangiopancreatography, 4.4%). Four cases were diagnosed after operation of acute abdomen laparotomy. There were four cases of abdominal plain film, one case of PTCD (percutaneous transhepatic cholangial drainage) and one case of mesenteric angiography. As shown in Figure 4, six main examinations (endoscopy, CT, gastrointestinal radiography, ultrasound, MR, MRCP) were chosen according to different clinical features; for the 26 patients with bellyache, the percentage of the six main examinations was 61.5, 61.5, 26.9, 23.1, 7.7 and 3.8%, respectively; for the 16 patients with jaundice, the percentage was 75.0, 56.3, 18.8, 50.0, 25.0 and 12.5%, respectively; for the 9 patients with bloating, the percentage was 55.6, 55.6, 44.4, 11.1, 0 and 11.1%, respectively; for the seven patients with gastrointestinal bleeding, the percentage was 85.7, 42.8, 42.8, 28.6, 14.3 and 0%, respectively.

The first choice of examination was the digestive tract endoscopy, followed by CT, gastrointestinal radiography, ultrasound, MR and MRCP. In addition, sometimes abdominal plain film, PTCD, mesenteric angiography could have tips.

Selection of six main auxiliary examination (digestive tract endoscope, CT, gastrointestinal radiography, ultrasound, MRI, MRCP) according to the different clinical features.

As shown in Figure 5, tumors were diagnosed by digestive endoscopic biopsy methods (35 cases) and pathological examination after surgery (39 cases); digestive endoscopes: gastroscopy (24 cases), duodenoscopy (six cases) and colonoscopy (three cases). Of 39 patients underwent surgery, 20 underwent biopsy by digestive endoscopy before surgery: gastroscopy (11 cases), duodenoscopy (six cases) and colonoscopy (three cases); ten underwent surgery after the lesions were found by CT and ultrasound. Of the 18 patients who did not undergo surgery: patients got diagnosis and treatment by duodenoscopy, which included ERCP(endoscopic retrograde cholangiopancreatography), common bile duct stent implantation, duodenal papilla incision, etc.; 13 by gastroscopy; two by CT; and one was found by ultrasound.

For patients with jejunal tumors, all of the five underwent surgery: one was diagnosed via colonoscopy before surgery, one received diagnosis during surgery, one was discovered by imaging (CT, ultrasound and gastrointestinal radiography) before surgery, one underwent laparotomy in other hospital.

Duodenum: 26 cases of surgery, of which, 15 preoperative degestive endoscopy. 18 cases of non-operation, of which, 3 duodenal endoscopy, 13 gastroscopy; Jejunum: all of surgery, 1 colonoscopy; Ileum: all of surgery, 2 colonoscopy.

There are eight patients with ileal tumors, all of them underwent surgery: before surgery, two were diagnosed via colonoscopy, two were discovered by CT, one was diagnosed by imaging (CT and mesenteric angiography); there patient received diagnosis after laparotomy.

3.4. Clinical Features

About 12.3% of the patients received regular physical examination thereafter the small intestinal tumors was discovered; 87.7% had obvious clinical symptoms and 70.2% of which had gastrointestinal symptoms: bellyache (45.6%), bloating (15.8%), gastrointestinal bleeding (12.3%), nausea and vomiting (19.3%), abdominal mass (3.5%), acid regurgitation and belching (7.0%), anal stopping exhaust defecation (10.5%), and diarrhea (1.8%). Intestinal obstruction occurred in 15 patients.

The clinical manifestations were different in different locations (P=0.001) (Table 4). Bellyache was the most common clinical manifestation in patients with duodenal tumors, especially located in ampullary duodenum (62.5%),

while non-ampullary duodenum (5.0%), and the difference was significant compared with other locations (*P*=0.000). Anal stopping exhaust defecation was the main clinical manifestation of ileal tumors (37.5%), the difference was statistically significant (*P*=0.021). No obvious clinical performance was also the characteristics of ileal tumors (37.5%), followed by non-ampullary duodenal tumors (20%), the difference was statistically significant (*P*=0.020).

Table 4. *The analysis between clinical features and location.*

	Duodenum	Jejunum	Ileum	Ampulla	P
Gender Male	9	4	2	12	0.278
Female	11	1	6	12	
Age ＜60	6	2	2	8	0.944
⩾60	14	3	6	16	
Smoking No	15	4	8	21	0.386
Yes	5	1	0	3	
Drinking No	17	4	8	22	0.580
Yes	3	1	0	2	
Family tumor history					0.379
No	19	5	7	24	
Yes	1	0	1	0	
Clinical features					
Bellyache	9	4	6	8	0.089
Jaundice	1	0	0	15	0.000
Bloating	4	0	3	2	0.169
Gastrointestinal bleeding	3	1	1	2	0.859
Nausea, vomiting	6	0	3	2	0.101
Abdominal mass	0	1	1	0	0.057
Anorexia	1	0	1	2	0.817
Acid regurgitation, belching	3	0	0	1	0.357
Anal stopping exhaust defecation	1	0	3	1	0.021
Diarrhea	1	1	0	0	0.150
Other	3	1	0	4	0.658
No obvious features	4	0	3	0	0.020

Clinical manifestations were different in different pathology (Table 3): compared to patients with stromal and other tumors, the most common clinical manifestation in patients with adenocarcinoma was jaundice, with statistically significant difference (*P*=0.030). Diarrhea was the clinical manifestations of stromal tumors (14.3%), the difference was significant (*P*=0.020) compared with other tumors. Atypical other clinical manifestation was more seen in stromal tumors (42.8%), the difference was significant (*P*=0.023). Abdominal pain was the primary clinical manifestation of extremely rare other pathological types, namely, one case of angioendothelioma, one carcinoid and one large B cell lymphoma.

3.5. The Treatment of Choice

A total of 31 patients received only surgery, eight underwent chemotherapy after surgery and 18 got supportive treatment (Table 1). No effect of age on the choice of of the three treatments: operation, postoperative chemotherapy and supportive treatment (*P*=0.205) (Table 5). The percentage of patients with surgery (including postoperative chemotherapy) in non-ampullary duodenum, duodenum ampullary, jejunum and ileum tumors was 23.1%、43.6%、12.8%、and 20.5 %, respectively. Every patient with jejunal or ileal tumor was given a positively operation treatment(*P*=0.017); patients with tumors of different pathological types had no significant different treatment choice (*P*=0.261) (Table 5).

Table 5. *Differences in treatment selection.*

	Surgery	Surgery +chemotherapy	Supportive therapy	P
Age				0.205
＜60	10	5	5	
⩾60	21	3	13	
Location				0.017
Non-ampullary duodenum	7	2	11	
Jejunum	5	0	0	
Ileum	8	0	0	
Duodenal ampulla	11	6	7	
Pathology				0.261
Adenocarcinoma	23	7	17	
Stromal	6	0	1	
Other	2	1	0	

A total of seven SBA patients received chemotherapy, all of which underwent postoperative chemotherapy; the main chemotherapy regimen was fluorouracil and (or) platinum. Among them four cases (75%) underwent “FOLFOX” regimen, the other three were given "Carmofur", "Xeloda" and "Ft-207" oral chemotherapy, respectively.

One patient of diffuse large B cell lymphoma located in Duodenal bulb underwent one course of systematic chemotherapy, which was “Rituximab 600mg d0+DDP 140mg d1+Ara-C 3 q12h d2+DXM 40mg D1-2", had survived more than three years till now from the operation.

3.6. Comparison of Different Treatments and Prognosis

A total of 46 patients of small intestine tumors had complete followed-up data and OS, male to female ratio was 1:1.09, of which, 16 patients were younger than 60 years of age (34.7%), 18 patients had the tumors located in non-ampullary duodenum (39.1%). A total of 31 patients got surgery only, eight patients got postoperative chemotherapy and 18 patients got supportive therapy only. The medium overall survival (mOS) of the three groups was 16.7, 26.8 and three months, respectively. The survival curves of

supportive therapy group, surgery group and postoperative chemotherapy group are shown in Figure 6 (supportive therapy vs surgery group, *P*=0.000; supportive therapy vs postoperative chemotherapy group, *P*=0.000; surgery vs postoperative chemotherapy group, *P* >0.05).

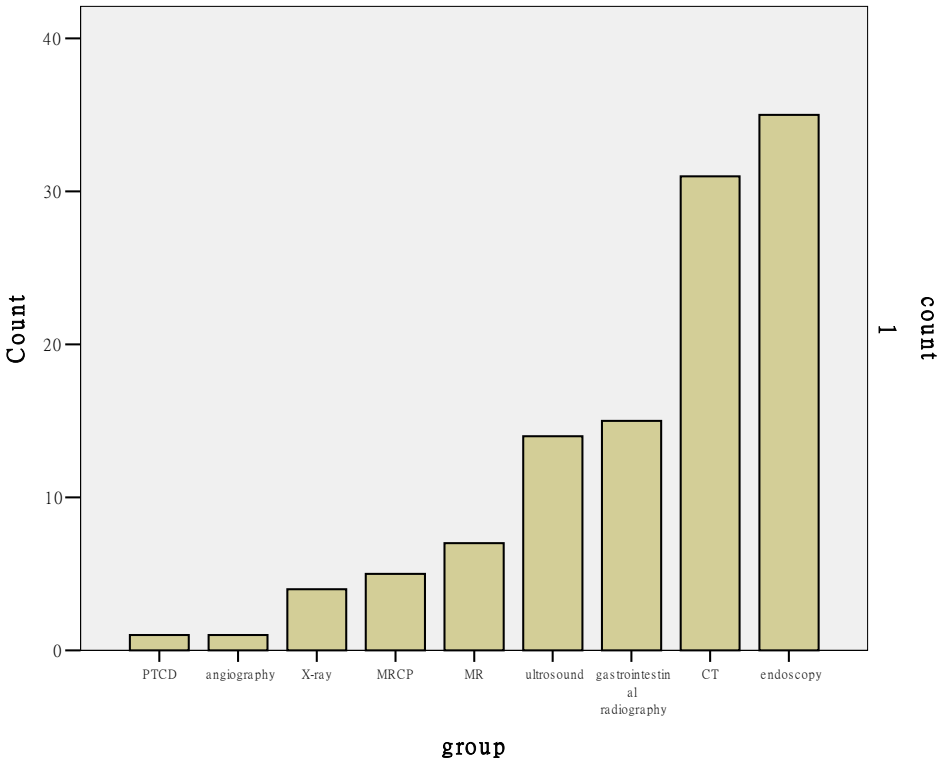

Figure 3. *First-choice of examination.*

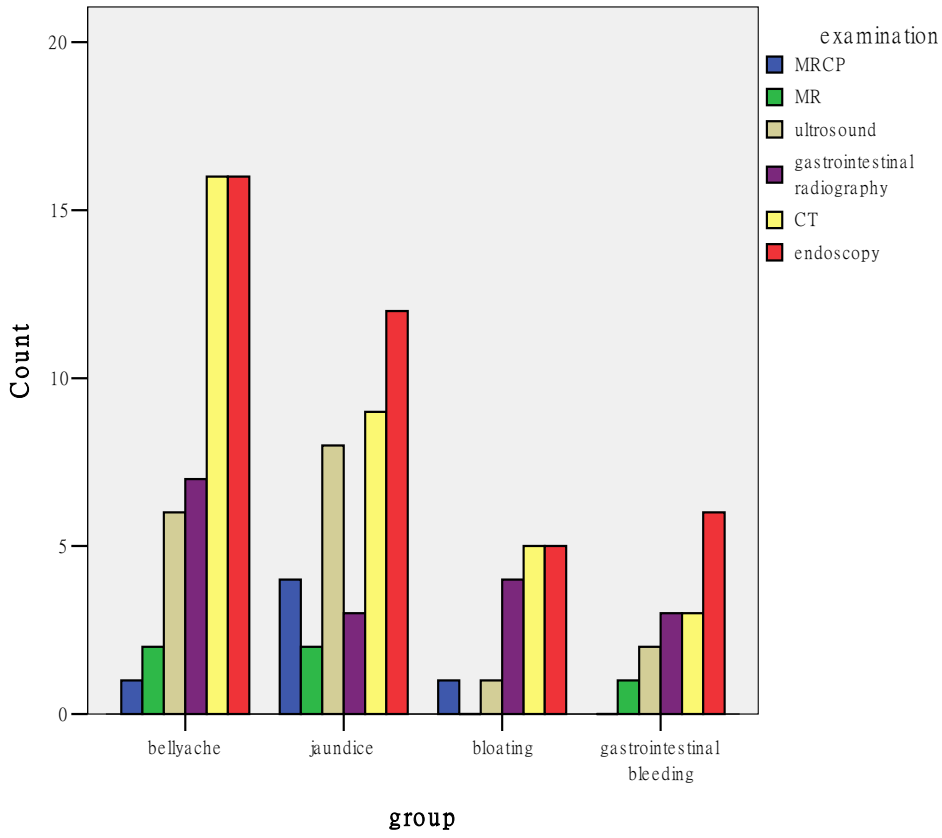

Figure 4. *First-choice examinations according to clinical features.*

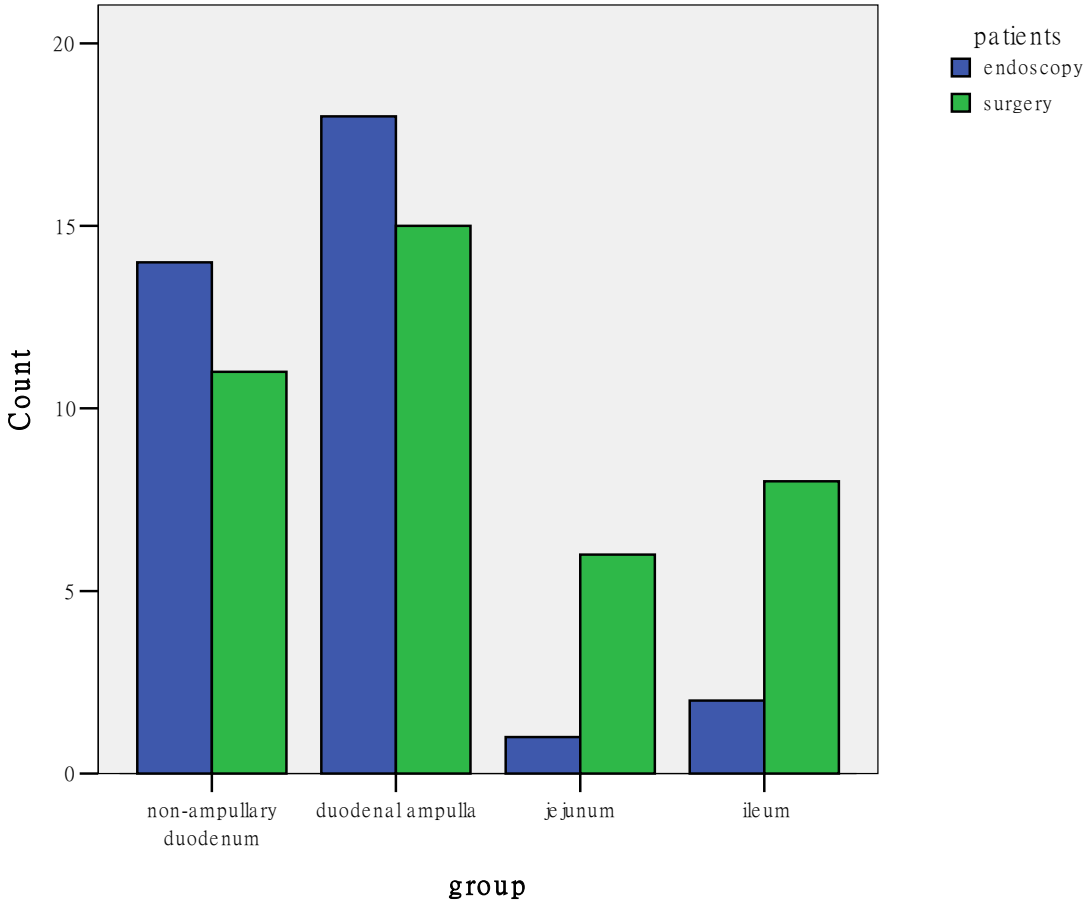

Figure 5. *The number of patients got diagnosis by digestive endoscopy and surgery according to different location.*

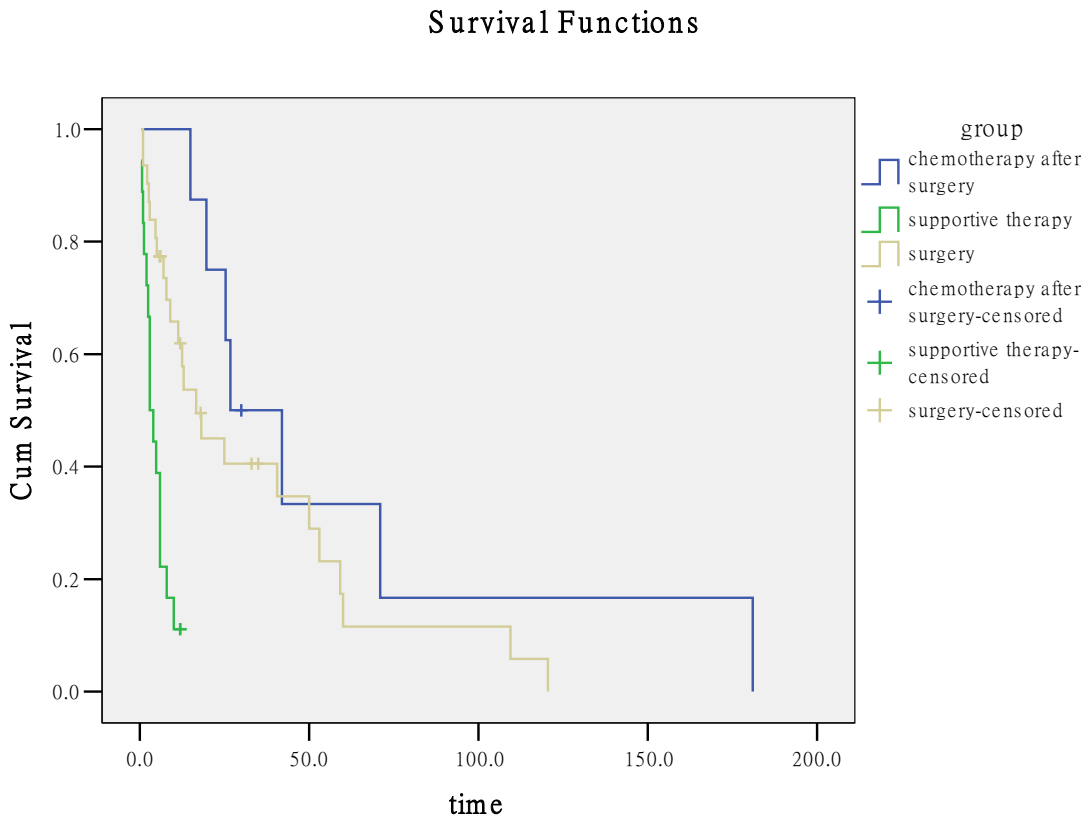

Figure 6. *Survival curve of supportive therapy group, surgery group, postoperative chemotherapy group (3.0 vs 16.7 vs 26.8 m).*

MOS in supportive therapy, surgery and postoperative chemotherapy group was 3, 16.7 and 26.8 months respectively. Significant difference existed between supportive therapy and surgery group; Supportive therapy was significantly different from postoperative chemotherapy; there was no significant difference between surgery and postoperative chemotherapy.

For all patients underwent radical surgery, multivariate analysis showed that: Sex (P=0.010) and age (P=0.022) were independent prognostic factors of OS; Men had poor prognosis than women, the elderly had poorer prognosis than younger. Tumor location, stage, pathological type, postoperative complications and whether chemotherapy or not did not show any correlation with prognosis.

4. Discussion

Small intestine is the longest section of digestive tract, the most main part of digestion and absorption, starting at pylorus and terminating in cecum. The total length in adult is five ~ seven meters, including duodenum, jejunum, ileum. However, this tumor is rare. The global incidence of small intestinal malignant tumor is below (0.3~2)/10,0000 persons [2]. Compared with colon, incidence of small intestinal tumor is lower [3], with total incidence less than 1/10,0000 [4]. Although accounting for 75% of the length of digestive tract, and 90% intestinal surface area, small intestinal tumors accounte for only 3-6% of gastrointestinal malignant tumors [5]. Various theories Have put forward to explain the relatively rarity: rapid turnover of intestinal mucosa cells lead to cells exfoliate before accumulation of gene mutation. Intestinal mucosa cells exposed to carcinogenic agents were limited, because of fast transport, lack of bacterial degradation activity with lower bacterial load, and relatively dilute alkaline environment [6]. Low levels of precancerous activating enzyme may be protective [7]. Some studies have shown that small intestines produce less endogenous reactive oxygen species (ROS) than colon, so that it can deal with oxidative stress more effectively, thereby reducing the oxidative [8] damage.

Common clinical symptoms include abdominal pain, hemorrhage, obstruction, and abdominal mass, lack of specificity. When patients were found abdominal mass, abdominal pain, intestinal obstruction, hemorrhage of digestive tract, clinicians might consider more likely lesions of stomach and colorectum. Small intestinal tumor early has no obvious symptoms and signs, lack of specific diagnostic method, therefore early diagnosis is difficult and misdiagnosis rate is high. So far, diagnosis and therapy of this tumor is inconclusive. Such cases were rarely reported, with regional differences. Occurrence of this tumor may have great relevance with genetic, lifestyle and environmental factors, finding out the differences maybe helpful for individual treatment.

We analyzed the basic clinical characteristics of 57 patients with small intestinal tumors including gender, age, diagnosis and pathology, compared different treatment and prognostic factors of 47 patients with complete followed-up data. Our study provided a basis for clinical diagnosis, treatment, prognosis and prevention of this tumor.

Smoking, alcohol, and other medical conditions such as Krohn's disease (CD), familial adenomatous polyposis (FAP), ulcerative colitis, peptic ulcer disease, cholecystectomy, cystic fibros is associated with high risk of small intestinal tumors [7]. Our study showed, smoking is associated with incidence.

This study showed: adenocarcinoma was the majority, followed by stromal tumors. Long term survival of stromal tumors was up to 71.4%, while the adenocarcinoma only 10.6%, perhaps because the majority of stromal tumors are benign and operation resection rate is high. There are differences to judge stromal tumors benign or malignant. In clinical, for stromal tumors less than five cm (centimeter) and nuclear division number ranging from one to 2/50 HPF (high power field), tumor metastasis may also happen. At present, most scholars tend to agree the view of dangerous degree classification put forward by Fletcher et al. [9].

Reported in literature, hidden bleeding, occult emaciation, occult periumbilical pain were the most common clinical manifestations of most, named as “three hidden symptoms” [10]. This study showed: abdominal pain was the most first symptoms of small intestinal tumors (45.6%). 26.3% patients were found due to intestinal obstruction treatment. Multi-center research of South Korean reported, about 90% intestinal adenocarcinoma was already at the late stage when underwent operation [11]. Prognosis of this primary malignant tumors was directly related to the time of diagnosis [12], attention should be paid to explore the methods for early diagnosis.

In our study, digestive endoscopy, CT, gastrointestinal radiography, ultrasound, and MR were the most common examinations. The first choice of examination was digestive endoscopy for patients with abdominal pain, jaundice, bloating and gastrointestinal bleeding. CT was the first choice of examination of abdominal pain and bloating. 46.2 % of surgical patients got diagnosed with digestive endoscopy before surgery. Checking for Superior mesenteric angiography should be considered if small intestinal tumors was not clear via other examinations. Duodenal tumors can be diagnosed preoperatively via endoscopy, CT, gastrointestinal radiography, ultrasound and MR, etc. 30.8% jejunum and ileum tumors were diagnosed after exploratory surgery, exploration rate of ileum tumors was as high as 37.5%.

In the course of clinical application of laparoscopic treatment on small intestinal tumors, for patients with gastroscopy or colonoscopy showed no abnormalities in recurrent right lower quadrant, periumbilical pain or vomiting then resolved after defecation, intermittent melena, blood in the stool or diarrhea, while other auxiliary examination was still not clear for diagnosis, early laparoscopic exploration is of great significance, which can not only avoid illness of incur loss through delay, but make the corresponding

operation plan implemented and treatment measures for the next step taken immediately. Recently, some reports suggested that the diagnosis rate of small intestinal tumors can be improved by the combination of balloon assisted endoscopy, capsule endoscopy [13], abdominal CT and gastrointestinal barium contrast examination [14]. According to our clinical practice, we recommend whole digestive tract radiography, superior mesenteric angiography and Laparoscopic exploration for special inspection of suspected small bowel tumors.

Since incidence of small intestinal tumors is low, few literature related about the best therapy. According to our survival curve, surgery is the most appropriate. However, due to difficult early diagnosis, when the lesions were found, most missed the best radical surgery opportunity. Operation was different according to location of the tumors: jejunal and ileal tumors were prone to local resection and anastomosis; for duodenum tumors, tumor with near surounding resection was feasible, or pancreaticoduodenectomy, while the prognosis of pancreatic duodenal resection showed no better, i.e. larger trauma pancreaticoduodenectomy not the only best operation mode for duodenal tumors, which needs to be further confirmed by large samples.

It is reported, chemotherapy might have therapeutic effect on primary malignant small intestinal tumors, but the best chemotherapy regimen has not been determined [15]. Despite lack of evidence to support the delivery of small intestinal tumors for adjuvant chemotherapy, American national cancer database analysis showed that the use of chemotherapy increased from 8% in 1985 to 24% in 2005 [16]. Reported that, curative effect of fluoropyrimidine oxaliplatin in advanced SBA [17, 18] and the same regimen of adjuvant chemotherapy in CRC, led to French recommendation of adjuvant chemotherapy in stage III SBA with fluorouracil and oxaliplatin based after R0 resection. In our study, patients underwent postoperative adjuvant chemotherapy had survival time prolonged compared with underwent surgery only, but without statistical significance. We don't think chemotherapy effective on small intestinal tumors.

Some research showed, primary tumor of duodenum had poorer prognosis compared with that of jejunum or ileum [19, 20, 21]. Other poorer prognostic factors had also been reported: elderly, pT4 stage, poorer differentiation, positive margins, lymphatic invasion and lymph node ratio $\geqslant$10% [20, 22, 23]. But multiple factors analysis of our study showed, prognosis is associated with gender: male has poorer prognosis than female; followed by age, the older the worse prognosis. Instead，prognosis is not relevant to location, staging and pathological type, postoperative complications and whether chemotherapy or not. The conclusion needs multi center analysis of larger samples to become more potent.

5. Conclusions

Small intestinal tumor is a rare disease, with atypical clinical symptoms, difficult to diagnosis early. Endoscopy and CT are the main means of inspection. Small intestinal tumors mostly occur in the duodenum. Adenocarcinoma is the most common pathological type. Gender and age are independent prognostic factors for OS. Surgery is the most effective means of treatment. Whether chemotherapy necessary or not is controversial.

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