

Characteristics of small bowel tumors detected by double balloon endoscopy: A Chinese single-center study

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Abstract *Objective:* Small intestinal tumors (SBTs) were difficult to be discovered before surgery. The emergence of double-balloon enteroscopy (DBE) and capsule endoscopy (CE) have greatly improved the evaluation of SBTs and facilitated a more precise preoperative diagnosis. Yet little data exist in China regarding clinical efficacy of DBE and clinical characteristics of SBTs. The aim of our study was to clarify the clinical characteristics of SBTs and analyze the efficacy of DBE examination in the detection and diagnosis of SBTs. *Methods:* We retrospectively reviewed patients who underwent DBE in our hospital between June 2011 and July 2014. Patients who were diagnosed with SBTs by DBE were included in the study. *Results:* A total of 316 patients underwent 321 DBE procedures, 80 (25.3%) of whom were suspected to have an SBT. And 59 of the 80 subjects were diagnosed with SBT finally. The majorities (59.3%, 35/59) of the patients diagnosed with SBT were males, whose average age was 61.8 years (SD ±11.0 years). DBE were frequently performed in patients with obscure gastrointestinal bleeding (66.1%), abdominal pain (16.9%). The common SBTs identified were: gastrointestinal stromal tumors (GISTs) (24/59, 40.7%), adenocarcinomas (13/59, 22.0%), lymphomas (6/59, 10.2%) and benign polyps (6/59, 10.2%). Jejunum had the highest detection rate (47.5%, 29/61). During the follow-up period (3 months to 3 years), 14 patients were submitted to chemotherapy and two patients died of tumor. *Conclusion:* The most high frequency type and location of SBTs detected in our hospital were different from western countries. DBE is a valuable and safe examination for SBTs.

Key words small bowel tumors (SBTs); double-balloon enteroscopy (DBE); capsule endoscopy (CE); clinical characteristics

Small bowel tumors (SBTs), whether benign or malignant, account for 3%–6% of all digestive neoplasms [1–3]. And the incidence is increasing in the past decade according to some regional studies [4–5]. In the western countries, adenocarcinoma, carcinoid and lymphoma are the three most common SBTs, which are preferentially located in the ileum, duodenum, and jejunum in decreasing order [5–6]. However, the epidemiology may be different in China. And little data involving large patient samples are available regarding the epidemiology and clinical characteristics of SBTs in China.

The lack of signs, symptoms and definite preoperative diagnostic tests with variable efficacy make SBTs difficult to be diagnosed [7]. In this regard, double-balloon endoscopy (DBE) and capsule endoscopy (CE) have recently been developed and are important in detecting small bowel diseases. DBE, in particular, could give more information for the treatment by taking biopsies and marking

the location of lesion.

From June 2011 to July 2014, 321 examinations were performed in 316 patients, 80 of whom were suspected to have small intestinal tumors (SBTs) by DBE examination. In this context, the study was conducted to determine the value and safety of DBE and clinical characteristics of SBTs.

Patients and methods

A total of 316 patients who were with negative upper and lower GI Endoscopy previously underwent 321 DBE procedures between June 2011 and July 2014 in our hospital. There were 120 women and 196 men with a mean age of 48.5 years (range, 14–79 years). Eighty patients were suspected to have SBTs by DBE and written informed consent for the procedure was obtained from each patient. Of those patients, 13 did not accept surgery in our institution or the final diagnosis was not clear. Fifty-seven patients were diagnosed with SBTs finally.

DBE was performed using a Fujinon enteroscope (FN 450-P5/20, Fujinon Inc., Japan). All DBE procedures were performed by specialists who followed the procedure originally described by Yamamoto^[8]. Monitored anesthesia that combined propofol with fentanyl was offered to the each patient by an anesthetist.

The anterograde approach was chosen for those suspected to have a jejunal lesion suggested by other examinations such as computed tomography and capsule endoscopy performed prior to DBE, whereas the retrograde approach was initially selected when the patient was suspected with a ileac lesion. Methylene combined with glycerol was injected at the end of accessible site if the first observation was incomplete, in order to facilitate the subsequent approach.

Data recorded included patient demographic information, hemoglobin level, indication of DBE, DBE approach, endoscopic findings, tumor location, CE findings, abdominal CT findings, DBE-associated complications and histologic diagnosis if applicable.

Continuous variables are presented as the means \pm standard deviations and were analyzed with the ANOVA test. Categorical variables are presented as percentages and were analyzed with Pearson's chi-square test. Analysis was performed with the statistical software SPSS version 21.

Results

In this study, a total of 321 DBE examinations were performed in 316 patients (196 males, mean age 48.5 years, range from 14 to 79 years). Eighty cases of tumors were suspected by DBE, giving a positive rate of 25.3% (80/316). Because 13 patients did not accept surgery in our institution or the final diagnosis was not clear. Eight patients were diagnosed with Crohn's disease or intestinal tuberculosis. That is, of the 80 patients, finally positive DBE findings were observed in 59 patients and the accuracy of DBE was 88.1% (59/67). Fifty-nine DBE procedures were performed in 59 patients (41 anterograde, 34 retrograde), and no complications including acute pancreatitis perforation and bleeding occurred during the procedures. The clinical characteristics can be seen in Table 1.

Indications for DBE and hemoglobin levels

In the 59 patients with SBTs, the indication for performing DBE was obscure gastrointestinal bleeding (OGIB) in 39 (66.1%) cases, abdominal pain in 10 (16.9%) cases, intestinal obstruction in 5 (8.5%) patients, and others (Table 1). The duration of OGIB was more than half a year in nearly half (19/39) of the patients with OGIB. The mean hemoglobin level of the 59 patients with SBTs was 9.2 g/dL (SD \pm 2.8), and 19 patients (13 with GISTs and 3 with adenocarcinomas) were given blood transfusions.

Table 1 Clinical characteristics

Characteristic	No. of patients	%
Age (years)		
Mean	61.8	
SD	11.0	
Range	14–79	
Sex		
Male	35	59.3
Female	24	40.7
Indications for DBE		
OGIB	39	66.1
Abdominal pain	10	16.9
Intestinal obstruction	4	6.8
Abdominal distension	2	3.4
Vomiting	2	3.4
Marasmus	1	1.7
Constipation	1	1.7
Hemoglobin (g/dL)		
Mean	9.2	
SD	2.8	

The duration time of OGIB was more than half a year in nearly half (19/39) patients.

Location and endoscopic characteristics of lesions

Among the 59 cases of SBTs, those located in the jejunum had the highest detection rate (47.5%, 29/61). It should be noted that benign polyps and GISTs were discovered simultaneously in two patients. The location of SBTs is shown in Table 2. Most malignant presented as a single lesion under the endoscopic view, protruding into the intra-luminal mass in the small bowel. The unsmooth surface of the tumor was seen most frequently, showing the appearance of erosion, ulcer or stenosis only (Fig. 1).

Histological analysis

A final diagnosis of SBT was reached through a combination of DBE biopsy histology and/or histology obtained from surgical specimens if applicable. The classification of tumors was as follows: 24 (40.7%) cases of GIST (7 low risk, 6 moderate risk, 8 high risk, 2 unknown), 13 (22.0%) adenocarcinoma, 6 (10.2%) lymphoma, 6 (10.2%) benign polyp, 5 (10.2%) lipoma, and others (Table 2). Benign polyps and GISTs were diagnosed simultaneously in two patients. After surgery, there were 34 patients diagnosed as having malignant SBT.

CE and abdominal CT

Among the 67 patients that were suspected of having tumors by DBE, 17 cases were examined by CE before DBE, and the positive rate was 64.7% (11/17). Forty-two of 67 cases underwent abdominal CT. If CT showed the lesions that was in accordance with the final diagnosis

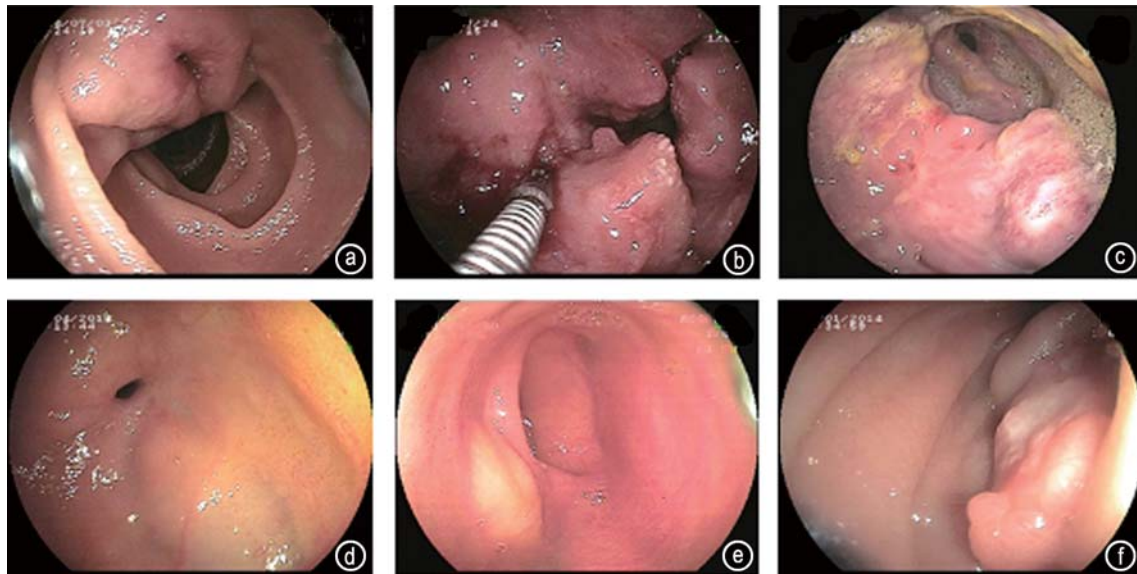


Fig. 1 Typical endoscopic image. (a) GIST; (b) Adenocarcinoma; (c) T cell lymphoma; (d) B cell lymphoma; (e) Lipoma; (f) Carcinoid

Table 2 Classification and location of tumors ($n = 61$)

	Total		Location							
	<i>n</i>	%	Duodenum		Jejunum		Ileum		Ileum/jejunum overlap	
	<i>n</i>	%	<i>n</i>	%	<i>n</i>	%	<i>n</i>	%	<i>n</i>	%
GIST	24	40.7	3	12.5	16	66.7	5	20.1	0	0
Adenocarcinoma	13	22.0	3	13.6	7	53.8	3	23.1	0	0
Lymphoma	6	10.2	1	16.7	1	16.7	4	66.7	0	0
Benign polyp	6	10.2	1	16.7	1	16.7	2	33.3	2	33.3
Lipoma	5	8.5	1	20	2	40	2	40	0	0
Hamartoma	2	3.4	0	0	0	0	2	9.5	0	0
Carcinoid	2	3.4	0	0	1	3.4	1	4.8	0	0
Lyphangioma	1	1.7	0	0	0	0	1	4.8	0	0
Hemangioma	1	1.7	0	0	1	3.4	0	0	0	0
Metastatic neoplasm	1	1.7	0	0	0	0	1	4.8	0	0

Benign polyps and GISTs were discovered simultaneously in two patients

and wall thickening with enhancement or signs that suggested tumors, the results were considered positive. And the positive rate was 69.0% (29/42).

Operation and follow-up

Surgery was performed in 40 patients (32 in our institution, 8 in local hospitals). During the follow-up period that ranged from 3 months to 3 years, 12 patients were submitted to chemotherapy after surgery, and 2 lymphoma patients without qualification for surgery were given CHOP (cyclophosphamide, doxorubicin, vincristine and prednisone) and two patients died of tumors.

Discussion

The diagnosis of small intestinal lesions was previously a big challenge because of its location and length. How-

ever, the uses of DBE and CE into clinical practice have changed the approach to small intestinal significantly. Moreover, Biopsies and therapeutic procedures were also possible in most of SBTs by DBE [9], and DBE has proved to be a safe and effective procedure by some worldwide centers' studies [10-13]. This study aimed to evaluate the value of DBE and examine the clinical characteristics of SBTs that discovered by DBE in China.

This study found that SBTs, as a whole, were more common in men than women (59.3% vs. 40.7%), and the median age at diagnosis was 61.8 years. For over half of the patients diagnosed with SBT in our study, the indication for DBE was a suspected OGIB (Table 1). Indeed, OGIB has proven to be a classic indication for SBT in a number of recent studies [14-16].

The frequency of SBTs in patients who receives DBE has been reported to be 10.0%, 13.9% and 25% according to studies performed in Germany, Japan, and Korea

respectively. The incidence of SBTs diagnosed by DBE in our study is 25.3% (80/316) and 59 patients eventually diagnosed with SBT. The higher incidence of SBT demonstrated in our database may be attributable to the fact that the symptoms of our patients were severe. For example, hemorrhage of digestive tract is overt totally and duration time of OGIB was more than half a year in nearly half (19/39) patients. In our study, the most three common tumors are GIST, adenocarcinoma, lymphoma. However, in the western countries, adenocarcinoma, carcinoid, lymphoma are the most common SBTs^[5-6]. What's more, Canfemi *et al*^[10] and Partridge *et al*^[17] identified carcinoid tumor which diagnosed only two cases in our study as the most common SBT in their studies both in America. The majority of SBTs in our patients were identified in the jejunum (47.5%, 29/59), which is not consistent with data, as reported by Canfemi *et al*^[10] and Partridge *et al*^[17]. There are several studies^[1,5] described that the association between carcinoid tumor and the ileum is well-documented and this may be the reason why the most location is ileum in western countries. The association between GIST and jejunum was also reported by some studies^[18-19]. Thus, the most three common SBT and location were different from that of the western countries. The uncommon epidemiology may represent a true population difference.

DBE and CE are important ways in detecting small intestinal lesions, but the CE has some limitations such as inability to sample biopsies, or to mark the location of the tumors and has the risk of retention^[20]. Compared with CE, DBE can take biopsies at some regions doctors want, and marking the location for the next therapy^[21]. But the procedure of DBE is complex and time-consuming, so CE may be used for screening the small lesions and DBE for further diagnosis. Surgical resection with necessary chemotherapy is the effective therapy for malignant tumors at present^[22-23].

Limitations of the study are as follows: the data of the study were collected retrospectively, and the diagnoses of 13 of 80 subjects were not clear. In addition, 8 patients received surgery in local hospital, and the information may be not accurate.

In summary, DBE which can obtain direct observation and biopsy has high clinical practice value in the diagnosis of SBTs. The most common SBTs identified were GIST, adenocarcinoma and lymphoma, and the majority of SBTs were identified in the jejunum, which were different from western countries. Of course, future larger scale studies are warranted.

Conflicts of interest

The authors indicated no potential conflicts of interest.

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