

Original Article

Endoscopic ultrasonography detecting in duodenal protuberant lesions is a better available way?

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Abstract: Aims: To examine endoscopic ultrasonography (EUS) diagnostic accordance rate and safety on duodenal protuberant lesions and to identify duodenal protuberant lesions characteristics. Materials and Methods: Patients were diagnosed as duodenal protuberant lesions with endoscopic examination and underwent EUS examination. EUS mainly observed lesions characteristics including origin, boundary, echogenicity, infiltration etc. Biopsy specimen has taken from duodenal protuberant lesions and was diagnosed on pathology. Results: A total of 540 patients were diagnosed as duodenal protuberant lesions by EUS, 572 cases of duodenal protuberant lesions were found out. There were not statistically significant on gender ($\chi^2=0.13$, $P>0.05$) and age ($t=0.11$, $P>0.05$) between benign and malignant duodenal protuberant lesions. Duodenal bulb was most easy to suffer from duodenal protuberant lesions ($F=7.784$, $P<0.05$). For different diseases, duodenal protuberant lesions sizes varied greatly. Most of benign duodenal protuberant lesions were from mucous layer, muscular layer, adventitia, and many of malignant duodenal protuberant lesions would come from total full thickness duodenal wall tissue. There were different iconographic characteristics in different duodenal protuberant lesions by EUS examination, diagnostic accordance rate on duodenal protuberant lesions by EUS was much higher than endoscopy, and it was safety. Conclusion: In conclusion, EUS is an available and safety way to detect duodenal protuberant lesions.

Keywords: Endoscopic ultrasonography, duodenal diseases, diagnosis, disease attributes

Introduction

Duodenal protuberant lesions may cause clinical symptoms such as abdominal pain, abdominal distension, and obstruction of duodenum. Besides, some of duodenal protuberant lesions would have malignant potential. However, endoscopy would not distinguish duodenal protuberant lesions, and diagnostic accordance rate is lower [1, 2]. With the development of endoscopic techniques and devices, endoscopic ultrasonography (EUS) has become a new available way to detect duodenal protuberant lesions.

EUS is a better nonsurgical technique for diagnosis on gastrointestinal tract tumors [3]. Most of gastrointestinal protuberant lesions are distributed on mucous layer, submucosa or muscular layer, endoscopy have difficulty in diagnosing and distinguish protuberant lesions. EUS can observe lesions characteristics includ-

ing origin, depth of lesions, boundary, echogenicity, infiltration and so on, and it is an integral method to evaluate patients who are suspected of gastrointestinal tract tumors before treatment [4, 5].

This study is aim to examine the prevalence age and gender among duodenal protuberant lesions patients, and to identify duodenal protuberant lesions distributions, sizes and origin, EUS diagnostic accordance rate and safety, endoscopic examination findings and EUS iconographic characteristics among duodenal protuberant lesions patients.

Patients and methods

The study was approved by the Institutional Ethical Committee of Renmin Hospital of Wuhan University. Informed consent was obtained from all participants before the study commencement.

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Patients' selection

All patients underwent endoscopic examination, and were diagnosed as duodenal protuberant lesions. A total of 551 duodenal protuberant lesions patients with endoscopy findings were enrolled, and 540 patients were diagnosed as duodenal protuberant lesions by EUS, 11 patients were identified that were misdiagnosed by endoscopic examination. These were outpatients and inpatients who visited endoscopy center from August 2007 to March 2015.

Instruments and methods

Using Olympus Q260J electronic gastroscope, Olympus α 5, EUME-1, UE260, UCT240 endoscopic ultrasonography system and mircoprobe (12 MHz and 20 MHz) (Olympus, Tokyo, Japan) to detect, and endoscopy mainly observed lesions characteristics including quantity, size, surface, erosion, boundary, color and so on. EUS mainly observed lesions characteristics including origin, boundary, echogenicity, infiltration and so on. EUS examination by direct contact with the cyst detected the lesions and surrounding. Biopsy specimen has taken from duodenal protuberant lesions and was diagnosed on pathology.

Statistical analysis

All statistical analyses were assessed using SPSS for Windows version 17.0 (SPSS, Chicago, the U.S.A). Continuous variables such as duodenal protuberant lesions shapes were presented as mean \pm standard deviation (SD). Categorical variables such as diagnosis on duodenal protuberant lesions, duodenal protuberant lesions distributions, were expressed as proportion and percentages. Comparison of continuous variables used *t* test. Comparison of categorical variables used ANOVA and χ^2 test respectively. A two-sided *P* value <0.05 was regarded as statistically significant.

Results

Prevalence on age and gender among duodenal protuberant lesions patients

There were 551 patients were diagnosed as duodenal protuberant lesions by endoscopic examination, 319 (57.89%) were male, 232 (42.11%) were female, aged 16-79 years, mean 50.47 ± 12.48 years. Examination by EUS, 11

patients were without duodenal protuberant lesions. There were 540 patients that were diagnosed as duodenal protuberant lesions by EUS, 572 cases of duodenal protuberant lesions were found out, and 313 (57.96%) were male, 227 (42.04%) were female, aged 16-79 years, mean 50.43 ± 12.46 years. 495 (91.67%) patients were diagnosed as benign duodenal diseases, including 290 (58.59%) male and 205 (41.41%) female, mean 49.56 ± 13.46 years, and 45 (8.33%) patients were diagnosed as malignant duodenal diseases, including 25 (55.56%) male and 20 (44.44%) female, mean $49.22.24 \pm 17.35$ years.

However, there were not statistically significant on gender between benign and malignant duodenal protuberant lesions ($\chi^2=0.13$, $P>0.05$), there were not statistically significant on age between benign and malignant duodenal protuberant lesions, either ($t=0.11$, $P>0.05$).

Prevalence on duodenal protuberant lesions characteristics among endoscopic examination findings

Observed on duodenal protuberant lesions by endoscopy, there were several characteristics on the duodenal protuberant lesions: size of duodenal protuberant lesions among patients were from 0.2 centimeters to 4.0 centimeters, shapes of duodenal protuberant lesions among patients were round, curve, funicular, lobulated, flat, mamillary and so on. Among duodenal protuberant lesions, there were 446 protuberant lesions that were sole, 54 protuberant lesions that were multiple. There were 497 (86.89%) protuberant lesions that shape were glabrate, 59 (10.31%) were hyperaemia and erosion, 16 (2.80%) were calloused or granular. Besides, there were 566 (98.95%) protuberant lesions without pedicles, 6 (1.05%) with pedicles.

Prevalence on distributions among duodenal protuberant lesions

There were 572 cases of duodenal protuberant lesions were found out by EUS. Most of duodenal protuberant lesions were distributed on the duodenal bulb (411 cases, 71.85%), and then, there were 127 (22.20%) cases of duodenal protuberant lesions were found out in the descendant duodenum, much fewer of duodenal protuberant lesions were distributed on the edge of duodenal bulb and duodenum, both

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Table 1. Distributions among duodenal protuberant lesions

Diagnosis	Distributions			
	Duodenal bulb	Descendant duodenum	Edge of duodenal bulb and duodenum	Both duodenal bulb and duodenum
Duodenal plica	5	2	0	0
Inflammation	26	0	0	0
Squeeze out of duodenal enteric cavity	18	1	3	0
Cystis	120	59	14	2
Ectopic pancreas	14	0	1	0
Gastrointestinal stromal tumor	20	7	1	0
Polyp	61	11	4	1
Bile papilla and minor duodenal papilla	53	6	0	0
Brunner cystis	32	2	4	1
Lipoma	36	24	2	0
Angeioma	17	4	0	0
Leiomyoma	4	0	0	0
Lymphoma	0	1	0	1
Carcinoma of head of pancreas extension and carcinoma of duodenal	5	10	0	0
Total	411	127	29	5

#Duodenal bulb was most easy to suffer from duodenal protuberant lesions ($F=7.784$, $P<0.05$).

Table 2. Sizes among duodenal protuberant lesions

Diagnosis	Average size (cm)
Duodenal plica	(0.93±0.25)×(1.08±0.30)
Inflammation	(0.64±0.35)×(0.70±0.46)
Squeeze out of duodenal enteric cavity	-
Cystis	(0.64±0.27)×(0.70±0.30)
Ectopic pancreas	(0.64±0.30)×(0.75±0.29)
Gastrointestinal stromal tumor	(1.66±0.96)×(1.91±1.36)
Polyp	(0.44±0.32)×(0.55±0.39)
Bile papilla and minor duodenal papilla	(0.65±0.22)×(0.75±0.26)
Brunner cystis	(0.37±0.19)×(0.48±0.26)
Lipoma	(0.81±0.31)×(0.89±0.33)
Angeioma	(1.14±0.96)×(1.25±0.88)
Leiomyoma	(1.58±0.78)×(1.60±0.90)
Lymphoma	-
Carcinoma of head of pancreas extension and carcinoma of duodenal	-

duodenal bulb and duodenum. There are only 29 (5.07%) cases and 5 (0.88%) cases of duodenal protuberant lesions were distributed on the edge of duodenal bulb and duodenum, both duodenal bulb and duodenum. Duodenal bulb was most easy to suffer from duodenal protuberant lesions, and there was statistically significant ($F=7.784$, $P<0.05$) (**Table 1**).

Prevalence on sizes among duodenal protuberant lesions

Most of duodenal protuberant lesions that diagnosed as benign duodenal diseases, could

detect lesions clear boundary, however, most of malignant duodenal protuberant lesions such as lymphoma or duodenal protuberant lesions came from squeezed out of duodenal enteric cavity could not observe lesions clear boundary. In particular, in malignant duodenal protuberant lesions, gastrointestinal stromal tumor (GIST) was much bigger, average sizes would common over 1 centimeter. However, for different diseases, duodenal protuberant lesions sizes varied greatly.

Different benign duodenal protuberant lesions also had characteristics: leiomyoma were much

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Table 3. EUS diagnostic accordance rate on duodenal protuberant lesions

Diagnosis	Diagnostic accordance rate by EUS (%)	Omission diagnostic rate by EUS (%)
Duodenal plica	7 (100)	0 (0)
Inflammation	24 (92.31)	2 (7.69)
Squeeze out of duodenal enteric cavity	20 (90.91)	2 (9.09)
Cystis	178 (91.28)	17 (8.72)
Ectopic pancreas	14 (93.33)	1 (6.67)
Gastrointestinal stromal tumor	23 (82.14)	5 (17.86)
Polyp	75 (97.40)	2 (2.60)
Bile papilla and minor duodenal papilla	55 (93.22)	4 (6.78)
Brunner cystis	39 (100)	0 (0)
Lipoma	61 (98.39)	1 (1.61)
Angeioma	3 (14.29)	18 (85.71)
Leiomyoma	3 (75.00)	1 (25.00)
Lymphoma	2 (100)	0 (0)
Carcinoma of head of pancreas extension and carcinoma of duodenal	14 (93.33)	1 (6.67)
Total	518 (90.56)	54 (9.44)

#EUS diagnostic accordance rate on different diseases of duodenal protuberant lesions were no different ($\chi^2=0.00$, $P>0.05$).

Table 4. Origin of duodenal protuberant lesions

Diagnosis	Origin
Duodenal plica	-
Inflammation	Mucous layer, submucosa, muscular layer
Squeeze out of duodenal enteric cavity	-
Cystis	Submucosa
Ectopic pancreas	Mucous layer, submucosa, muscular layer
Gastrointestinal stromal tumor	Muscular layer
Polyp	Mucous layer
Bile papilla and minor duodenal papilla	Most came from mucous layer, also could be origin from mucous layer to adventitia
Brunner cystis	Submucosa
Lipoma	Submucosa
Angeioma	Most came from mucous layer, also could be origin from mucous layer to adventitia
Leiomyoma	Submucosa, muscular layer
Lymphoma	From total full thickness duodenal wall tissue
Carcinoma of head of pancreas extension and carcinoma of duodenal	From total full thickness duodenal wall tissue

big, average sizes were common over 1 centimeter, others benign duodenal protuberant lesions, such as inflammation, cystis, ectopic pancreas, Branner cystis and so on were small, average sizes were common below 1 centimeter (**Table 2**).

Prevalence on EUS diagnostic accordance rate on duodenal protuberant lesions

Diagnostic accordance rate on duodenal protuberant lesions by EUS was much higher than endoscopy. In the study, EUS diagnostic accordance rate was 90.56%, and in pervious stud-

ies, endoscopic diagnostic accordance rate was only 30%-40% [1, 2]. EUS diagnostic accordance rate on different diseases of duodenal protuberant lesions were no different, and there was no statistically significant ($\chi^2=0.00$, $P>0.05$).

There were 572 cases of duodenal protuberant lesions were found out by EUS, 7 cases of duodenal plica all could find out by EUS, were diagnosed as duodenal plica, diagnostic accordance rate was 100%. There were 26 cases of inflammation, 24 cases were found out by EUS, diagnostic accordance rate was 92.31%. 22

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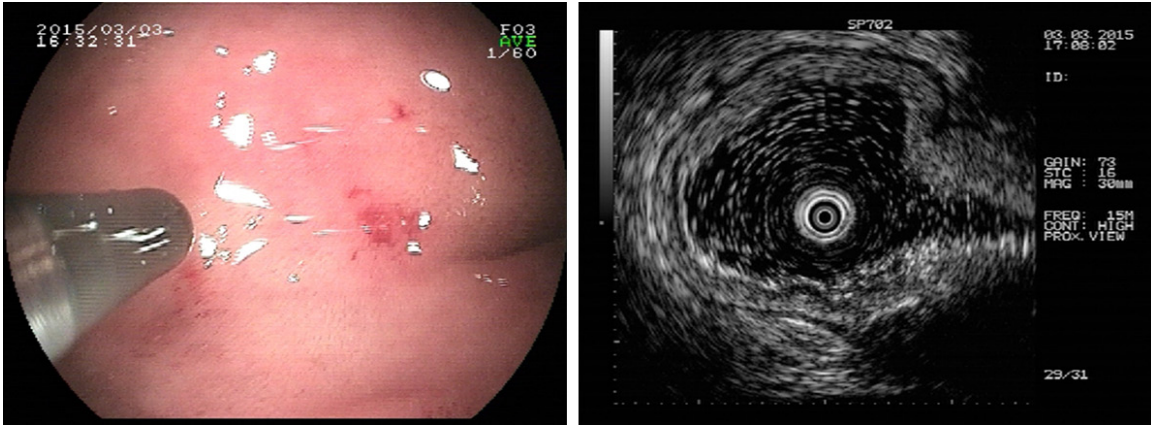


Figure 1. Inflammation. Duodenal inflammation often came from mucous layer, submucosa, or muscular layer, iconographic characteristics were uneven or hypoechoic lesions.

cases were squeezed out of duodenal enteric cavity, 20 cases were found out by EUS, diagnostic accordance rate was 90.91%, and the origin of protuberant lesions: 10 cases were squeezed out of gallbladder, 2 cases were squeezed out of liver, 1 cases were squeezed out of common bile duct, 1 cases were squeezed out of venae cava inferior, 8 cases were unknown origin. There were 195 cases of cystis, 178 cases were found out by EUS, diagnostic accordance rate was 91.28%. 15 cases of ectopic pancreas, EUS found 14 cases out; diagnostic accordance rate was 93.33%. There were 28 cases of GIST, EUS detected 23 cases out, and diagnostic accordance rate was 82.14%. 77 cases of polyp, 75 cases were found out by EUS, diagnostic accordance rate was 97.40%. There were 8 cases of bile papilla and 51 cases of minor duodenal papilla; EUS found 55 cases out, diagnostic accordance rate was 93.22%. And there were 39 Brunner cystis, all were diagnosed by EUS, diagnostic accordance rate was 100%. 62 cases of lipoma, 60 cases were found out by EUS, diagnostic accordance rate was 98.39%. Angioma were 21 cases, however, only 3 cases were diagnosed by EUS, diagnostic accordance rate was 14.29%. And there were 4 cases of leiomyoma, EUS detected 3 cases out, diagnostic accordance rate was 75.00%. 2 cases of lymphoma all were diagnosed by EUS; diagnostic accordance rate was 100%. 15 cases of malignant duodenal protuberant lesions, including carcinoma of head of pancreas extension and carcinoma of duodenal, 14 cases were found out by EUS, diagnostic accordance rate was 93.33% (Table 3).

Prevalence on the safety for EUS examination

There were not significant uncomfortable on EUS examination, all patients could endure on the examination.

Prevalence on origin of duodenal protuberant lesions

Most of benign duodenal protuberant lesions came from mucous layer, muscular layer, and adventitia. For example, duodenal inflammatory submucosa protuberant lesions, ectopic pancreas, would come from mucous layer, submucosa, muscular layer; most of cystis, Brunner cystis, and lipoma came from submucosa; most of bile papilla and minor duodenal papilla came from mucous layer, and also could be origin from mucous layer to adventitia. However, many of malignant duodenal protuberant lesions would come from total full thickness duodenal wall tissue. Besides, duodenal protuberant lesions that came from squeezed out of duodenal enteric cavity were not origin from duodenal wall tissue (Table 4).

Prevalence on EUS iconographic characteristics of duodenal protuberant lesions

There were different iconographic characteristics in different duodenal protuberant lesions by EUS examination, such as hypoechoic lesions, equal echo, anechoic lesions, and mixed echo lesions and so on. Besides, EUS could also detect protuberant lesions origin, for example, protuberant lesions came from mucous layer, submucosal, muscular layer, or adventitia, that all could help doctors to distinguish duodenal protuberant lesions.

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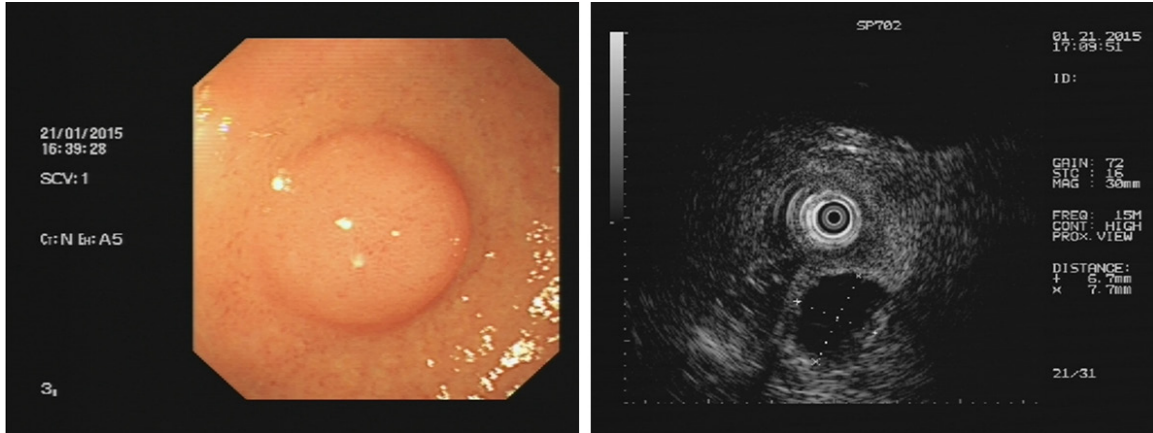


Figure 2. Cystis often came from submucosa, iconographic characteristics were anechoic lesions.

Table 5. EUS iconographic characteristics of duodenal protuberant lesions

Diagnosis	EUS iconographic characteristics
Duodenal plica	Mixed echo lesions, duplicature folded, duodenal wall tissue was completed
Inflammation	Uneven or hypoechoic lesions, mucos thickened
Squeeze out of duodenal enteric cavity	Duodenal wall structure was completed, oppression object acoustic image out of duodenal enteric cavity
Cystis	Anechoic lesions
Ectopic pancreas	Equal echo or hypoechoic lesions within tubular anechoic area
Gastrointestinal stromal tumor	Hypoechoic lesions
Polyp	Hypoechoic lesions
Bile papilla and minor duodenal papilla	Mixed echo lesions within tubular anechoic area
Brunner cystis	Anechoic lesions
Lipoma	Hyperecho lesions
Angeioma	Favaginous mixed echo lesions within anechoic area
Leiomyoma	Mixed echo lesions
Lymphoma	Hypoechoic lesions, duodenal wall tissue was thick and completed
Carcinoma of head of pancreas extension and carcinoma of duodenal	Mixed echo or hypoechoic lesions, duodenal wall tissue structure was disappeared, adventitia incomplete, lesions boundary was unclear

For instance, duodenal plica iconographic characteristics were mixed echo lesions. Duodenal inflammation often came from mucous layer, submucosa, or muscular layer, iconographic characteristics were uneven or hypoechoic lesions (**Figure 1**). And cystis often came from submucosa, iconographic characteristics were anechoic lesions (**Figure 2**). However, duodenal protuberant lesions that were diagnosed as squeezed out of duodenal enteric cavity, duodenal wall structure was completed, and could find oppression object acoustic image out of duodenal enteric cavity (**Table 5**).

Discussion

Duodenal protuberant lesions incidence is about 0.3%-1.5%, incidence is lower than other gastrointestinal tract diseases [1, 2]. With the development of endoscopic techniques and

devices, nowadays, detected rate on duodenal protuberant lesions is higher. For lesions most are distributed on mucous layer, submucosa or muscular layer, endoscopy has difficulty in diagnosing and distinguish protuberant lesions. EUS can scan duodenal wall tissue structure and show it clearly [6]. A pervious study has show that EUS is one of the best way to detect gastrointestinal tract protuberant lesions [7, 8].

In benign duodenal protuberant lesions, cystis, polyp, lipoma are most common disease. Cystis can be caused by congenital embryonic developmental anomaly, it also can be due to stimulation, injury, or some unknown causes, and epithelioglandulars and ducts hyperplasia or atrophy, then would make gland duct jam, mucus retention [9, 10]. Cystis common comes from submucosa, EUS iconographic character-

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istics are anechoic lesions, and lesions boundary is clear, and lesions surface seems clearly [11]. Lipoma is composed of fibrous capsule surrounds mature adipose tissue, and it is one of benign tumors [12]. Lipoma tends to be solitary, spherical, smooth protuberant lesions [13], and its origin is submucosa, too. It is a hyperechoic lesion under EUS observation. Polyp often comes from mucous layer, EUS iconographic characteristics is hypoechoic lesions, towards to duodenal enteric cavity, its boundary is clear [14].

Besides, benign duodenal protuberant lesions also including Brunner cystis, inflammation, bile papilla and minor duodenal papilla, ectopic pancreas, angioma and so on. Brunner cystis common come from duodenal submucosa, and it is anechoic lesions under EUS observation [15]. Duodenal inflammation can be origin from mucous layer, submucosa or muscular layer, almost is distributed on the duodenal bulb, and there are several characteristics on it: uneven or hypoechoic lesions, mucosal thickened, congestion, even erosion, etc. Bile papilla and minor duodenal papilla common come from mucous layer, and also can be origin from mucous layer to adventitia, there are mixed echo lesions, and there are tubular anechoic area in the lesions under EUS observation. Ectopic pancreas would be from mucous layer, submucosa, or muscular layer, observed on that are equal echo or hypoechoic lesions, within tubular anechoic area. However, most of angioma come from mucous layer, also can be origin from mucous layer to adventitia, can be distributed on duodenal bulb and descendant duodenum, under EUS observation, that are faviginous mixed echo lesions, anechoic area although some of angiomas are much bigger than other benign duodenal protuberant lesions, final diagnosis for angioma should combine EUS with pathology.

In the malignant duodenal protuberant lesions, lymphoma, carcinoma of head of pancreas extension, carcinoma of duodenal and so on all are infiltration whole layers, from mucous layer to adventitia, in the duodenal wall tissue. Besides, under EUS observation, there are different iconographic characteristics on them: lymphomas is hypoechoic lesion, duodenal wall tissue is thick and completed, carcinoma is mixed echo or hypoechoic lesion, duodenal wall

structure disappears, adventitia is incomplete, lesions boundary is unclear [16].

GIST is a rare cancer but the most common sarcoma in the gastrointestinal tract, and GIST is not directly visualized by endoscopy without using EUS [17]. Observed on GIST, there are hypoechoic lesions coming from muscular layer, and sometimes, it is much bigger than other protuberant lesions [18-20]. In this study, GIST average sizes were common over one centimeter. The EUS characteristics may be useful in distinguishing between other protuberant lesions and GIST, usually, it is hypoechoic lesions detected by EUS [21].

Under EUS observation, there are the same iconographic characteristics on duodenal protuberant lesions that origin is from duodenal plica or squeezed out of duodenal enteric cavity, duodenal wall tissue structure is completed. In duodenal plica can find out that it is mixed echo lesions, and duplicates are folded. For duodenal protuberant lesions that come from other organs or tissue and squeezed out of duodenal enteric cavity, also can find out the oppression object acoustic image out of duodenal enteric cavity.

Several limitations in the study we should highlight. As this study was only focus on the methods to detect duodenal protuberant lesions, the findings of this study would neglect treatments and follow-up on patients who were suffered from duodenal protuberant lesions. And patients all came from Asia, wouldn't be generalizable to the duodenal protuberant lesions patients who were in other countries.

Conclusion

In conclusion, this study has confirmed that gender and age have little effect on between benign and malignant duodenal protuberant lesions, middle-aged are much easier to suffer from duodenal protuberant lesions, most of duodenal protuberant lesions are benign diseases, and lesions mainly are distributed on duodenal bulb. There are different iconographic characteristics in different kind diseases of duodenal protuberant lesions by EUS examination. EUS is an available and safety way to detect duodenal protuberant lesions. However, final diagnosis for duodenal protuberant lesions should depend on pathology.

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Disclosure of conflict of interest

None.

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