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Original Article

Polypoid lesions of the gallbladder: report of 160 cases with special reference to diagnosis and treatment in China

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Abstract: Background: The preoperative diagnosis of gallbladder polypoid lesions is difficult, justifying the lack of consensus on the appropriate treatment. Objective: The aim of this study was to identify the characteristics of each type of polypoid lesion of the gallbladder and the indications for surgery. Methods: Between January 1999 and December 2012, clinical data were retrospectively correlated with the histopathologic characteristics of polypoid lesions in 160 patients who underwent cholecystectomy. Results: A total of 160 patients with benign polypoid lesions (including 49 tumor-like lesions and 75 adenomas) and 14 patients with malignant polypoid lesions (including 2 adenocarcinomas and 12 adenomas with malignant changes) were included in this study. One hundred and five (65.6%) of the patients had associated symptoms, and 70 (43.8%) had gallstones. Of the 49 patients with tumor-like lesions, 49 (100%) were correlated with chronic cholecystitis. A total of 72 (83.8%) patients with neoplasms had a single polyp compared with 25 (59.5%) of those with non-neoplastic polyps. The mean age of the patients with malignancy was 59.07±13.465 years, and 12 (85.7%) of these patients were over 50 years of age. The mean diameters of the benign and malignant polyps were 1.0±0.77 cm and 2.15±1.16 cm, respectively. Ten (100%) of the patients with malignancy had polyps of over 1 cm in size, as shown by ultrasound. Conclusion: Our findings indicate that tumor-like lesions, adenomas, and adenocarcinomas are the most common polypoid lesions of the gallbladder. Cholecystecomy should be done in patients with symptoms. The risk of malignancy is high in patients over 50 years of age; those with polyps with diameters of greater than 10 mm; and those with single polypoid lesions. The remainder of PLG patients without cholecystectomy should be followed up at regular intervals.

Keywords: Polypoid lesions, gallbladder, diagnosis, treatment

Introduction

Polypoid lesions of the gallbladder (PLGs) are lesions that protrude from the wall to the inside of the gallbladder. They are classified as non-neoplastic and neoplastic polyps. Non-neoplastic polyps include cholesterol, hyperplastic, and inflammatory polyps, adenomyomas, leiomyomas, fibromas, and lipomas. Neoplastic polyps include adenomas, adenocarcinomas, and squamous cell carcinomas [1]. According to the second edition of the WHO Histological Classification of Tumors of the Gallbladder and Extrahepatic Bile Ducts, cholesterol polyps, adenomyomatous hyperplasia, inflammatory polyps and xanthogranulomatous cholecystitis are all classified as tumor-like lesions [2].

PLGs are rare, and their true incidence is unknown. However, recent studies of healthy individuals have reported a prevalence of 5.6%-6.9% in the western world [3], which is significantly lower than that in Asia [4, 5]. Although most gallbladder carcinomas evolve from dysplasia and carcinoma in situ, the role of gallbladder adenomas in the pathogenesis of gallbladder carcinoma is still controversial. As a result, the discovery of a gallbladder polyp on imaging can pose a difficult management problem. Most of these lesions are benign; however, due to the poor prognosis of gallbladder carcinoma, this diagnosis must not be missed. Although the incidence of carcinoma is not high in PLGs, it is essential to diagnose gallbladder cancer at an early stage to achieve a good therapeutic outcome.

Table 1. Demographic and clinical characteristics of each group

	Tumor-like lesions	Adenoma	Adenocarcinoma	Adenoma associated with tumor-like lesions	Overall	P
n	49 (30.6%)	75 (46.9%)	14 (8.8%)	22 (13.8%)	160	
Sex						0.59
Male	24 (49%)	32 (42.7%)	4 (28.6%)	10 (45.5%)	70 (43.8%)	
Female	25 (51%)	43 (57.3%)	10 (71.4%)	12 (54.5%)	90 (56.3%)	
Age (yr)	52.22±12.76	52.29±12.53	59.07±13.465	52.05±9.717	52.83±12.38	0.274
≤20	0	1 (1.3%)	0	0	1 (0.6%)	
21~30	2 (4.1%)	3 (4%)	1 (7.1%)	0	6 (3.8%)	
31~40	7 (14.3%)	8 (10.7%)	1 (7.1%)	2 (9.1%)	18 (11.3%)	
41~50	14 (28.6%)	21 (28%)	0	8 (36.4%)	43 (26.9%)	
51~60	15 (30.6%)	24 (32%)	6 (42.9%)	9 (40.9%)	54 (33.8%)	
61~70	4 (8.2%)	10 (13.3%)	3 (21.4%)	2 (9.1%)	19 (11.9%)	
>70	7 (14.3%)	8 (10.7%)	3 (21.4%)	1 (4.5%)	19 (11.9%)	
History (month)	39.68±55.27	33.25±68.32	102.03±201.848	42.84±57.176	42.56±84.92	0.41
≤12	26 (53.1%)	47 (62.7%)	10 (71.4%)	12 (54.5%)	95 (59.4%)	
13~36	6 (12.2%)	13 (17.3%)	0	3 (13.6%)	22 (13.8%)	
>36	17 (34.7%)	15 (20%)	4 (28.6%)	7 (31.8%)	43 (26.9%)	
Symotom						0.509
Yes	35 (71.4%)	50 (66.7%)	9 (64.3%)	11 (50%)	105 (65.6%)	
No	14 (28.6%)	25 (33.3%)	5 (35.7%)	11 (50%)	55 (34.4%)	
Cholecystitis						0.000
Yes	49 (100%)	56 (74.7%)	3 (21.4%)	19 (86.4%)	127 (79.4%)	
No	0	19 (25.3%)	11 (78.6%)	3 (13.6%)	33 (20.6%)	
Operation						0.264
LC	29 (59.2%)	45 (60%)	5 (35.7%)	10 (45.5%)	89 (55.6%)	
OC	20 (40.8%)	40 (40)	9 (64.3%)	12 (54.5%)	71 (44.4%)	

In the current study, 160 patients with PLGs who underwent cholecystectomy were reviewed to correlate their clinical features with the histopathologic findings. The aim was to define the characteristics of PLGs to establish sound criteria for surgical indications for these patients and to determine the differences between benign and malignant PLGs.

Materials and methods

Patients

Between 1999 and 2012, 160 patients who complied with the definition of PLGs underwent cholecystectomies at the Department of Surgery at Huashan Hospital, Fudan University, Shanghai, China. Clinical data, including age, sex, symptoms, physical findings, and preoperative diagnostic evaluation findings were correlated with the patients' pathologic characteristics and PLG diagnoses. All of the patients were evaluated with ultrasonography (USG) before surgery was performed at the Ultrasonography Department of the 160 patients with PLGs, 34 (21.2%) who underwent cholecystectomy because of other gallbladder disease were not diagnosed with PLGs by USG preoperatively, while postoperative pathology indicated a PLG diagnosis. A total of 126 (78.8%) patients with concordant preoperative and postoperative diagnostic findings had PLGs.

Polyp size, number, surface, shape, location and the presence of stones were evaluated in the preoperative USG reports, and the compatibility of these findings with the histopathological data were analyzed.

According to the histopathological diagnoses, cholesterol polyps, adenomyomatous hyperplasia, inflammatory polyps and xanthogranulomatous cholecystitis were classified as tumor-like lesions and non-neoplasms. Adenoma and

Table 2. The gallstones of each group

	Tumor-like lesions	Adenoma	Adenocarcinoma	Adenoma associated with tumor-like lesions	Overall
Gallstone					
Yes	23 (46.9%)	35 (46.7%)	5 (35.7%)	7 (31.8%)	70 (43.8%)
No	26 (53.1%)	40 (53.3%)	9 (64.3%)	15 (68.2%)	90 (56.3%)
Number of stone					
1	8 (34.8%)	9 (25.7%)	2 (40%)	2 (28.6%)	21 (30%)
≤2	15 (65.2%)	26 (74.3%)	3 (60%)	5 (71.4%)	49 (70%)
(max) Size of stone (cm)					
≤1	14 (60.9%)	32 (91.4%)	3 (60%)	6 (85.7%)	55(78.6%)
1~2	4 (17.4%)	2 (5.7%)	1 (20%)	1 (14.3%)	8 (11.4%)
≥2	5 (21.7%)	1 (2.9%)	1 (20%)	0	7 (10%)
Cholesterol crystal					
Yes	3 (11.5%)	3 (7.5%)	0	3 (20%)	9 (10%)
No	23 (88.5%)	37 (92.5%)	9 (100%)	12 (80%)	81 (90%)

adenocarcinoma were classified as neoplasms. Benign gallbladder polyps were subdivided into the following classifications: tumor-like lesions, epithelial tumors (adenomas) and mesenchymatous tumors (fibroma, lipoma, and hemangioma). Malignant gallbladder polyps were considered gallbladder carcinomas.

Statistical analysis

Statistical significance was analyzed using the following tests, as appropriate: Student's t test, the Mann-Whitney U test, the chi-square test, Fisher's exact test, and the Kruskal-Wallis test. Statistical analyses were performed using SPSS 20.0 for Windows. A *P* value of <0.05 was considered to be statistically significant.

Results

Overall PLG patient results

Of the 160 patients with PLGs, 70 (43.8%) were males and 90 (56.3%) were females. There were no statistically significant differences among the four groups of PLG patients (i.e., those with tumor-like lesions, adenomas, adenocarcinomas, and adenomas with tumor-like lesions) in gender distribution (P=0.59). The patients' ages ranged from 17 to 82 years (mean of 52.83±12.38 years), and 97 (60.6%) were in their fourth and fifth decades. Their histories ranged from 0.03 to 720 months (mean of 42.56±84.92 months) and were <12 months for 95 (59.4%) patients. A total of 105 (65.6%) out of 160 patients had symptoms that led to ultrasonographic examination, and their polypoid gallbladder lesions were detected on USG during a checkup. The remaining 55 (34.4%) patients were asymptomatic. A total of 127 (79.4%) patients were confirmed by pathology to have chronic cholecystitis, and significant differences were observed among the groups (*P*<0.000). With regard to the choice of operation, 89 patients (55.6%) underwent laparoscopic cholecystectomy (LC), and 71 (44.4%) underwent open cholecystectomy (OC) (**Table 1**).

Among the 70 (43.8%) patients with gallstones, 21 (30%) had a single stone, and the remaining 49 (70%) had multiple stones. The diameter of the largest stone was less than or equal to 1 cm in 55 (78.6%) of the patients. Of the 90 (56.3%) patients with no stones, 9 (10%) had cholesterol crystals (**Table 2**).

The average wall thickness was 0.342±0.2 cm, and there were no differences detected among the groups (*P*=0.504). All patients underwent preoperative USG examination, except for 35 without descriptions, and 89 (71.2%) PLGs were found to be located in the body, 12 in the neck (9.6%), and 17 (13.6%) at the bottom of the gallbladder. The remainder were located at the junction or at multiple sites. Comparisons of the polyp numbers and sizes identified by preoperative USG and postoperative pathology, excluding those patients lacking a precise description, revealed that 93 (76.9%) and 106

(70.7%) patients had a single polyp, respectively, and the remainder had multiple polyps. The average polyp size according to USG was 1.53±0.896 cm, and it was 1.106±0.877 cm according to the pathology results. All polyps were found to be larger by USG examination. USG revealed that of the 99 patients with definite descriptions, 73 (73.7%) had hyperechoic, 9 (9.1%) had isoechoic, and 17 (17.2%) had hypoechoic polyps, and no significant differences were observed among the four groups of patients (P=0.238). Further, the 17 available CT reports showed that 14 (82.4%) of the patients had hyperechoic, 1 (5.9%) had isoechoic, and 2 (11.8%) had hypoechoic polyps, with no significant differences detected among the patient groups (P=0.509). Of those patients who had undergone preoperative CEA and CA199 blood tests, CEA was detected in 41, and only 1 (2.44%) showed an abnormal level. Out of 38 patients in which CA199 was detected, 33 (86.84%) showed levels within the normal range, and 5 (13.16%) showed high levels. There were no significant differences in the CEA and CA199 levels among the groups (P=0.374 and P=1, respectively) (**Table 3**).

Clinical and pathologic findings of each group

Of the 160 patients, a tumor-like lesion, adenoma, and adenocarcinoma (including 12 cases of adenoma with malignant changes) were found in 49 (30.6%), 75 (46.9%) and 14 (8.8%), respectively, and an adenoma with a tumor-like lesion was identified in 22 (13.8%). The tumor-like lesions included cholesterol polyps, adenomatous polyps, inflammatory polyps and other mixed proliferative diseases. The average ages (in years) for the four groups were 52.22±12.76, 52.29±12.53, 59.07±13.465 and 52.05±9.717, respectively, and there were no significant differences among the groups (P=0.274). A total of 15 (30.6%), 24 (32%), 6 (42.9%) and 9 (40.9%) patients were aged 51-60 years, which represented the predominant age group. The average disease histories (months) were 39.68±55.27, 33.25±68.32, 102.03±201.848 and 42.84±57.176 and this value was significantly higher in the adenocarcinoma group than in the other groups. However, none of the differences observed among the four groups were statistically significant (P=0.41). The numbers of PLGs complicated by chronic cholecystitis in the patients in the four groups were 49 (100%), 56 (74.7%), 3 (21.4%), 19 (86.4%), respectively, and significant differences were detected (P<0.000) (**Table 1**).

There were 23 (46.9%), 35 (46.7%), 5 (35.7%) and 7 (31.8%) patients with gallstones, and 8 (34.8%), 9 (25.7%), 2 (40%) and 2 (28.6%) had only a single stone. A total of 14 (60.9%), 32 (91.4%), 3 (60%) and 6 (85.7%) patients had stones with maximum diameters of less than 1 cm. The remainder of the PLG patients without stones had concomitant cholesterol crystals and totaled 3 (11.5%), 3 (7.5%), 0 and 3 (20%), respectively (**Table 2**).

With regard to the USG diagnosis before operation, 28 (82.4%), 1 (2.9%), 3 (8.8%), 0, 1 (2.9%), 1 (2.9%) and 0 of the patients with tumor-like lesions, except for 15 of those lacking a precise description, had lesions on the body, neck, bottom, neck and body, body and bottom, and cystic duct of the gallbladder, respectively. A total of 43 (71.7%), 8 (13.3%), 6 (10%), 1 (1.7%), 1 (1.7%), 0 and 1 (1.7%) of the patients with adenomas (excluding 15 with no description) had lesions on the body, neck, bottom, neck and body, body and bottom, neck and bottom, and cystic duct. With the exception of 1 adenocarcinoma patient with no description, 6 had lesions on (46.2%) the body, 2 (15.4%) on the neck, 4 (30.8%) on the bottom, and 1 (7.7%) on the neck and bottom. For the patients with adenoma with tumor-like lesions, 4 were lacking descriptions, 12 (66.7%) had lesions on the body, 1 (5.6%) on the neck, 4 (22.2%) on the bottom, and 1 (5.6%) on the body and the bottom. The USG findings of the polyp shapes and surface descriptions for the 6 patients with tumor-like lesions identified 5 (83.3%) with sessile polyps and 1 (16.7%) with a pedunculated polyp; in addition, and the polyp surfaces of 5 (83.3%) and 1 (16.7%) patient were irregular and smooth, respectively. Exact descriptions of polyp shapes were available for 16 adenoma patients, including 10 (62.5%) with pedunculated and 6 (37.5%) with sessile polyps. Further, exact descriptions of the polyp surfaces were available for 19 adenoma patients, including 15 (78.9%) and 4 (21.1%) that were irregular and smooth, respectively. These descriptions were also accessible for 9 of the adenocarcinoma patients, including 7 (77.8%) with pedunculated and 2 (22.2%) with sessile polyps, and all 9 (100%) were irregularly shaped.

Table 3. US, PE, CT, CEA, CA199 finding of each group

	Tumor-like lesions	Adenoma	Adenocarcinoma	Adenoma associated with tumor-like lesions	Overall	P
Position (US)						
No discription	15	15	1	4	35	
Body	28 (82.4%)	43 (71.7%)	6 (46.2%)	12 (66.7%)	89 (71.2%)	
Neck	1 (2.9%)	8 (13.3%)	2 (15.4%)	1 (5.6%)	12 (9.6%)	
Bottom	3 (8.8%)	6 (10%)	4 (30.8%)	4 (22.2%)	17 (13.6%)	
Neck+Body	0	1 (1.7%)	1 (7.7%)	0	2 (1.6%)	
Body+Bottom	1 (2.9%)	1 (1.7%)	0	1 (5.6%)	3 (2.4%)	
Neck+Bottom	1 (2.9%)	0	0	0	1 (0.8%)	
Cystic duct	0	1 (1.7%)	0	0	1 (0.8%)	
Shape (US)						0.094
No discription	43	59	5	19	126	
Pedunculated	1 (16.7%)	10 (62.5%)	7 (77.8%)	1 (33.3%)	19 (55.9%)	
Sessile	5 (83.3%)	6 (37.5%)	2 (22.2%)	2 (66.7%)	15 (44.1%)	
Surface (US)						0.374
No discription	43	56	5	16	120	
Smooth	1 (16.7%)	4 (21.1%)	0	2 (33.3%)	7 (17.5%)	
Irregular	5 (83.3%)	15 (78.9%)	9 (100%)	4 (66.7%)	33 (75%)	
Wall thickening (PE)	0.338±0.167	0.33±0.21	0.403±0.334	0.358±0.131	0.342±0.20	0.504
Number of polyp						
No discription or finding on US	22	15	1	1	39	
No discription on PE	7	2	0	1	10	
1 US	17 (63%)	51 (85%)	11 (84.6%)	14 (66.7%)	93 (76.9%)	
PE	25 (59.5%)	60 (82.2%)	12 (85.7%)	9 (42.9%)	106 (70.7%)	
2 US	2 (7.4%)	3 (5%)	0	3 (14.3%)	8 (6.7%)	
PE	4 (9.5%)	4 (5.5%)	0	7 (33.3%)	15 (10%)	
≥3 US	8 (29.6%)	6 (10%)	2 (15.4%)	4 (19%)	20 (16.6%)	
PE	13 (31%)	9 (12.3%)	2 (14.3%)	5 (23.8%)	29 (19.3%)	
Size of polyp (cm) US	1.086±0.392	1.52±0.78	2.62±1.37	1.537±0.907	1.53±0.896	0.001
PE	0.685±0.402	1.14±0.82	2.15±1.16	1.008±0.995	1.106±0.877	0.000
No discription or finding on US	26	25	4	2	57	
No discription on PE	22	17	4	9	52	
0.1~0.5 US	2 (8.7%)	2 (4%)	0	1 (5%)	5 (4.9%)	
PE	14 (51.9%)	14 (24.1%)	0	3 (23.1%)	31 (28.7%)	
0.6~1.0 US	10 (43.5%)	17 (34%)	0	3 (15%)	30 (29.1%)	
PE	9 (33.3%)	25 (43.1%)	1 (10%)	9 (69.2%)	43 (39.8%)	
1.1~1.5 US	7 (30.4%)	10 (20%)	1 (10%)	10 (50%)	28 (27.2%)	
PE	4 (14.8%)	11 (19%)	3 (30%)	0	18 (16.7%)	
1.6~2.0 US	4 (17.4%)	8 (16%)	4 (40%)	2 (10%)	18 (17.5%)	
PE	0	2 (3.4%)	3 (30%)	0	6 (5.6%)	
>2.0 US	0	13 (26%)	5 (50%)	4 (20%)	22 (21.3%)	
PE	0	6 (10.3%)	3 (30%)	1 (7.7%)	10 (9.3%)	
Echo pattern on US						0.238
No discription	28	27	2	18	61	
Hypoecho	2 (9.5%)	8 (16.7%)	3 (25%)	4 (100%)	17 (17.2%)	
Isoecho	3 (14.3%)	3 (6.3%)	3 (25%)	0	9 (9.1%)	
Hyperecho	16 (76.2%)	37 (77.1%)	6 (50%)	0	73 (73.7%)	
Perception on unenhanced image						0.509
No discription	45	67	11	20	143	
Hypoecho	0	1 (12.5%)	1 (33.3%)	0	2 (11.8%)	
Isoecho	0	1 (12.5%)	0	0	1 (5.9%)	
Hyperecho	4 (100%)	6 (75%)	2 (66.7%)	2 (100%)	14 (82.4%)	
CEA						0.376
No discription	39	60	6	14	119	
Normal	9 (90%)	15 (100%)	8 (100%)	8 (100%)	40 (97.56%)	
Unmormal	1 (10%)	0	0	0	1 (2.44%)	
CA199						1
No discription	42	60	6	14	122	
Normal	6 (85.71%)	13 (86.67%)	7 (87.5%)	7 (87.5%)	33 (86.84%)	
Unmormal	1 (14.29%)	2 (13.33%)	1 (12.5%)	1 (12.5%)	5 (13.16%)	

US: ultrasonography; PE: pathological examination.

Table 4. Different in some clinical and pathologic feature in non-neoplastic and neoplastic group

	Non-neoplasm	Neoplasm	P
n	49 (35.5%)	89 (64.5%)	
Sex			0.33
Male	24 (49%)	36 (40.4%)	
Female	25 (51%)	53 (59.6%)	
Age (yr)	52.22±12.76	53.36±12.84	0.619
≤50	23 (46.9%)	35 (39.3%)	0.386
>50	26 (53.1%)	54 (60.7%)	
History (month)	39.68±55.27	44.07±102.85	0.782
≤12	26 (53.1%)	57 (64%)	0.48
>12	19 (49.9)	32 (36%)	
Symotom			0.536
Yes	35 (71.4%)	59 (66.3%)	
No	14 (28.6%)	30 (33.7%)	
Gallstone			0.822
Yes	23 (46.9%)	40 (44.9%)	
No	26 (53.1%)	49 (55.1%)	
Cholecystitis			0.000
Yes	49 (100%)	59 (66.3%)	
No	0	30 (33.7%)	
Wall thickening (PE) (cm)	0.338±0.167	0.343±0.232	0.903
Number of polyp			
US 1	17 (63%)	62 (84.9%)	0.017
≥2	10 (37%)	11 (15.1%)	
PE 1	25 (59.5%)	72 (83.8%)	0.004
≥2	17 (40.5%)	15 (17.2%)	
Size of polyp (cm) US	1.086±0.392	1.70±0.98	0.000
PE	0.685±0.402	1.291±0.939	0.000
US ≤1	12 (52.2%)	19 (31.7%)	0.084
>1	11 (47.8%)	41 (68.3%)	
PE ≤1	23 (85.2%)	40 (58.8%)	0.014
>1	4 (14.8%)	28 (41.2%)	
Echo pattern on US			0.688
Hypoecho and Isoecho	5 (23.8%)	17 (28.3%)	
Hyperecho	16 (76.2%)	43 (71.7%)	
CA199			
Normal	6 (85.71%)	20 (86.96%)	0.288
Unmormal	1 (14.29%)	3 (13.04%)	

Descriptions of polyp shape were accessible for 3 of the patients with adenoma and tumor-like lesions, including 1 (33.3%) with a pedunculated and 2 (66.7%) with sessile polyps. In addition, the polyp surfaces of 2 (33.3%) and 4 (66.7%) of these patients were smooth and irregular, respectively. The four groups showed no significant differences in the polyp shape or surface descriptions (P=0.094 and P=0.374, respectively) (**Table 3**).

The average thicknesses of the gallbladder wall (cm) for each group were 0.338±0.167, 0.33±0.21, 0.403±0.334 and 0.358±0.131, and these measurements did not significantly differ (P=0.504). The polyp sizes (cm) were 1.086±0.392, 1.52±0.78, 2.62±1.37 and 1.537±0.907 as determined by USG, and they were 0.685±0.402, 1.14±0.82, 2.15±1.16 and 1.008±0.995 according to the pathology findings. These results were significantly different (P=0.001 and P<0.000 for the USG and pathology findings, respectively). A comparison of the preoperative ultrasonography with the postoperative pathology findings showed that 17 (63%) and 25 (59.5%) of the patients, respectively, had single polyps in the tumor-like lesion group, and for the other three groups, 51 (85%) and 60 (82.2%); 11 (84.5%) and 12 (85.7%); and 14 (66.7%) and 9 (42.9%) patients were found to have single polyps. According to the USG and pathology findings, the patients with polyps that were less than 1 cm in size totaled 12 (52.2%) and 23 (85.2%); 19 (38%) and 39 (67.2%); 0 and 1 (10%); and 4 (20%) and 12 (92.3%). The histopathologic results for the polypoid lesions for the 160 patients are shown in **Table 3**.

Results of non-neoplasm and neoplasm and benign and malignant patients

The 160 non-neoplasm (49, 35.5%) and neoplasm (89, 64.5%) (**Table 4**) patients were reclassified into benign (146, 91.3%) and malignant (14, 8.8%) (**Table 5**) groups, respectively, according to a comparison of the clinical and pathological data.

The majority of the adenoma and adenocarcinoma patients were female. In the non-neoplasm and neoplasm groups, the male to

Table 5. Different in some clinical and pathologic feature in benign and malignant group

	Benign	Malignant	P
n	146 (91.3%)	14 (8.8%)	
Sex			0.231
Male	66 (45.2%)	4 (28.6%)	
Female	80 (54.8%)	10 (71.4%)	
Age (yr)	52.23±12.15	59.07±13.465	0.048
≤50	66 (45.2%)	2 (14.3%)	0.025
>50	80 (54.8%)	12 (85.7%)	
History (month)	36.85±62.30	102.03±201.848	0.25
≤12	85 (58.2%)	10 (71.4%)	0.336
>12	61 (41.8%)	4 (28.6%)	
Symotom			0.912
Yes	96 (65.8%)	9 (64.3%)	
No	50 (34.2%)	5 (35.7%)	
Gallstone			0.526
Yes	65 (44.5%)	5 (35.7%)	
No	81 (55.5%)	9 (64.3%)	
Cholecystitis			0.000
Yes	124 (84.9%)	3 (21.4%)	
No	22 (15.1%)	11 (78.6%)	
Wall thickening (PE) (cm)	0.336±0.187	0.403±0.334	0.508
Number of polyp			
US 1	82 (75.9%)	11 (84.6%)	0.483
≥2	26 (24.1%)	2 (15.4%)	
PE 1	94 (69.1%)	12 (85.7%)	0.194
≥2	42 (30.9%)	2 (14.3%)	
Size of polyp (cm) US	1.41±0.75	2.62±1.37	0.022
PE	1.0±0.77	2.15±1.16	0.000
US ≤1	35 (37.6%)	0	0.001
>1	58 (70.7%)	10 (100%)	
PE ≤1	73 (74.5%)	1 (10%)	0.001
>1	24 (29.3%)	9 (90%)	
Echo pattern on US			0.043
Hypoecho and Isoecho	20 (22.7%)	6 (50%)	
Hyperecho	68 (77.3%)	6 (50%)	
CA199			
Normal	26 (86.67%)	7 (87.5%)	0.951
Unmormal	4 (13.33%)	1 (12.5%)	

female ratios were 24:25 and 36:53 (P=0.33), and those in the benign and malignant groups were 66:80 and 4:10, respectively (P=0.231). These differences were not significant. The average gallbladder wall thickness as determined by pathological examination (PE) in the non-neoplasm group was 0.338±0.167 cm, and it was 0.343±0.232 cm for the neoplasm group. No significant differences were detected between these groups (P=0.903). A comparison of the non-neoplasm and neoplasm groups revealed the presence of statistically significant differences between the patients with regard to chronic cholecystitis and polyp number and size. A total of 49 patients (100%) in the non-neoplasm group and 59 in the neoplasm group (66.3%) had chronic cholecystitis, and this difference chronic cholecystitis was significant (P<0.000). Preoperative USG showed that 17 patients (63%) in the non-neoplasm group had a single polyp and 10 (37%) had multiple polyps, 12 (52.2%) had polyps that were smaller than or equal to 1 cm, and 11 (47.8%) had polyps that were larger than 1 cm. In the neoplasm group, 62 (84.9%) patients had single polyps, and 11 (15.1%) had multiple polyps, and they were smaller than or equal to 1 cm in 19 (31.7%) and larger than 1 cm in 41 patients (68.3%). Postoperative pathology showed that 25 (59.5%) patients in the non-neoplasm group had a single polyp, 17 (40.5%) had multiple polyps, 23 (85.2%) had polyps that were smaller than or equal to 1 cm, and 4 (14.8%) had polyps that were larger than 1 cm. In the neoplasm group, 72 patients (83.8%) had a single polyp and 15 (17.2%) had multiple polyps, and they were smaller than or equal to 1 cm in 40 (58.8%) and larger than 1 cm in 28 (41.2%). The numbers of polyps identified by both preoperative USG and postoperative PE under direct vision significantly differed between the two groups (P=0.017, P=0.004). The average size of the non-neoplastic polyps was 1.086±0.392 cm as determined by USG, and it was 0.685±0.402 cm as shown by PE. For the neoplasm group, these values were 1.70±0.98 cm and 1.291±0.939 cm, respectively. The differences between the two groups were significant (P<0.000, P<0.000).

There were 146 (91.3%) benign and 14 (8.8%) malignant lesions. Gender, history and symptom data were not found to be correlated with the pathologic type of polypoid lesion of the gallbladder. However, the mean age of the patients with cancer was significantly greater than that of the patients with tumor-like lesions and adenomas. Malignant lesions were found in 12 (85.7%) of the 14 patients aged 50 or older. In contrast, benign lesions were found in 66 (45.2%) of the 146 patients aged 50 or younger (P=0.025). More women than men had neoplasms (adenoma and cancer), but there were no significant differences in gender between the patients with benign and malignant lesions (P=0.231). A total of 124 (84.9%) and 3 (21.4%) patients had benign and malignant polyps complicated with chronic cholecystitis, respectively, and this difference was significant (P<0.001). The maximal dimensions of the adenocarcinomas were significantly greater than those of the tumor-like lesions, adenomas and other types of lesions (P<0.001). All 14 malignant lesions measured at least 1.5 cm. The mean size of the polyps of the benign group as determined by preoperative ultrasound was 1.41±0.75 cm, and it was 2.62±1.37 cm in the malignant group. Postoperative pathology revealed that these values were 1±0.77 cm and 2.15±1.16 cm, respectively, indicating the absence of a significant difference (P=0.022, P<0.000). Preoperative USG revealed that the polyps of 10 (100%) patients were bigger than 1 cm, and those of 9 (90%) were greater than 1 cm according to the pathology findings. This difference was statistically significant (P<0.001). Further, the USG findings indicated that 68 (77.3%) of the patients in the benign group had hyperechoic polyps compared with 6 (50%) in the malignant group, and this difference was significant (P=0.043).

Discussion

Gallbladder polyps are currently the most common surgical vesicular pathology, and they are found during routine abdominal ultrasound with an increasing frequency. The reported incidence of malignant polyps has varied from 1% to 20% of resected PLGs among diverse study populations [6]. Some studies have even shown that, although they are uncommon, malignant polyps can be smaller in size, especially in the Asian population [7]. The current clinical use of the Christensen pathological classification in China involves the designation of polyps as tumor-like lesions and adenoma and then their further characterization as canceration of adenoma and carcinoma *in situ*. It is difficult to predict the significance or importance of a PLG preoperatively; however, there is always the concern that it may be a carcinoma of the gallbladder. Adenomas of the gallbladder are found in approximately 1% of cholecystectomies and comprise 10% of gallbladder polyps [8]. We found that 49 (30.6%), 75 (46.9%) and 14 (8.8%) of the patients' polyps were classified as tumor-like lesions, adenomas and adenocarcinomas, respectively. The majority of the tumor-like lesions were not malignant; however, some of the adenomatous polyps were malignant. The polyps of a total of 12 patients were classified as adenocarcinoma, accounting for 16% of the cases of adenoma. Further, of all of the patients with PLGs, 105 (65.6%) had abdominal pain or abdominal symptoms, and the remaining 55 (34.4%) had no symptoms. A total of 127 (79.4%) patients' polyps were complicated with chronic cholecystitis, and the remaining 33 (20.6%) had simple PLGs. This difference was statistically significant, suggesting that PLG patients commonly have symptoms and complicated chronic cholecystitis.

In recent years, along with dietary changes, the acceleration of the pace of life, increasing health awareness and the popularity of USG, the detection rate of PLG has increased, and nearly 85% of PLGs are detected by routine physical examination [9]. Abdominal ultrasound is the ideal examination for diagnosing PLGs, not only because of its accessibility and low cost but also because of its elevated sensitivity and specificity, which are 93% and 95.8%, respectively [10]. The sensitivity of abdominal ultrasound for the diagnosis of PLGs is superior to those of both oral cholecystography and CT. The evaluation of tumor markers in the blood (CEA and CA199) is not sufficiently effective for preoperative diagnosis. The accuracy of ultrasound for recognizing the presence of lesions was 78.8% in this study. The classification and comparison results showed that, according to the USG common indicators, such as polyp size and number, this procedure was effective in distinguishing between non-neoplastic and neoplastic and benign and malignant polyps, especially the latter. Obvious differences in the

shapes and surfaces of these lesions failed to be detected. However, the use of USG for the determination of the sizes and numbers of polyps was associated with errors, especially with regard to polyp size. These errors might have occurred due to the specimen collection and handling processes used and also the relevant experience of the ultrasound doctors. A significantly larger proportion of the neoplasms were single polyps compared with the non-neoplasms. USG preoperative evaluation of the malignant group showed that more polyps were larger in size compared with those in the benign group (2.62±1.37 cm and 1.41±0.75 cm, respectively). Postoperative pathology confirmed these findings (1.0±0.77 cm and 2.15±1.16 cm, respectively). In addition, a significant difference was detected in the echo display between the benign and malignant groups. To ensure for the accuracy of USG, it is recommended that ultrasound doctors have prior experience with this technique and have performed it at least 3 times before the operation. In addition, EUS should be used to ensure for an accurate diagnosis.

The poor prognosis of gallbladder carcinoma patients highlights the importance of differentiating between benign polyps and malignant or premalignant polyps to choose the appropriate treatment. The premalignant potentials of adenomas and other PLGs are unquestionable. Hence, all adenomas should be treated surgically. Currently, cholecystectomy is widely accepted as the treatment of choice for patients with a PLG >10 mm, based on earlier reports that most malignant polyps are found to be >1 cm on pathological examination. Of the 14 malignant patients in this study (mean age: 59.07±13.465 years), 12 (85.7%) were over 50 years old, and only 2 (14.3%) were less than 50 years old (and all were adenocarcinoma patients). Of the 146 patients in the benign group, 66 (45.2%) were less than and 80 (54.8%) were more than 50 years of age, and this finding was significantly different. The preoperative USG findings of the neoplastic group indicated that 62 (84.9%) of the patients had single polyps, and 72 (83.3%) were found to have single polyps by pathology. A total of 17 (63%) of the patients in the non-neoplasm group had single polyps as shown by USG, and this value was significantly increased to 25 (59.5%) using postoperative PE. Only 3 patients (21.4%) had polyps complicated with chronic cholecystitis in the malignant group compared with 124 in the benign group (84.9%), and this difference was statistically significant. However, gender, disease history, symptoms, and the coexistence of stones did not significantly differ. At present, the more accepted operation indications for patients older than 50 years of age include the appearance of symptoms and a single pedunculated polyp with a diameter of greater than 1 cm or accompanied by cholecystolithiasis [10, 11]. The latter three indications are consistent with the findings of the present study; however, it is still worth exploring whether gallbladder stones induce malignant transformation. Ito H et al. have reported that the concomitant presence of stones, a polypoid polyp shape, and polyp number are unreliable for distinguishing malignant neoplasms from benign neoplastic polyps or pseudopolyps [12]. These results are also in agreement with our findings.

It has always been clinically important to establish sound criteria for selecting patients with PLGs who require surgery. Some reports have suggested that polyps between 10 and 18 mm in size may have greater chances of being foci of adenocarcinoma, and in such cases, elective laparoscopic cholecystectomy should be performed for a good surgical candidate [13, 14]. Further, polyps bigger than 18 mm are at significant risk of being malignant and require open cholecystectomy [15]. However, the choice of operation should not be standardized, this choice should be comprehensively considered, especially for asymptomatic, young patients, in cases with a polyp diameter of over 1 cm, and in those involving more than one polyp. All operation indications should be considered along with some other indicators to determine whether an operation should be performed or whether the patient's condition should be regularly monitored. In the current study, 55 (34.4%) of the patients were asymptomatic, and 25 (15.7%) were less than 40 years of age. Further, 11 (47.8%) had polyps of greater than 1 cm in diameter in the non-neoplasm group as shown by USG, compared with 4 (14.8%) as determined by PE. In the benign group, 58 (70.7%) patients' polyps were greater than 1 cm in diameter as shown by USG, compared with 24 (29.3%) as determined by PE. Although some neoplastic lesions may undergo

malignant transformation, it is appropriate to relax the operation indications depending on the situation to avoid performing unnecessary procedures. Aldouri AQ et al. have reported that the risk of gallbladder cancer in polyps is related to the ethnic background of the patient [16]. However, patients with PLGs, even those with <1 cm-sized polyps, who do not undergo an operation should be assessed with regular ultrasonographic examinations [17].

In conclusion, the diagnosis and treatment of PLGs requires the comprehensive consideration of many aspects. LC was performed on a wide range of patients, greatly reducing their pain. However, this procedure resulted in long-term complications, and the minority of PLGs in the patients with benign polypoid polyps underwent malignant transformation. Therefore, surgical teams should reassure and relax patients and avoid performing unnecessary cholecystectomies.

Disclosure of conflict of interest

None.

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