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RAPID COMMUNICATION

Pre-operative predictive factors for gallbladder cholesterol polyps using conventional diagnostic imaging

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Abstract

AIM: To determine the clinical data that might be useful for differentiating benign from malignant gallbladder (GB) polyps by comparing radiological methods, including abdominal ultrasonography (US) and computed tomography (CT) scanning, with postoperative pathology findings.

METHODS: Fifty-nine patients underwent laparoscopic cholecystectomy for a GB polyp of around 10 mm. They were divided into two groups, one with cholesterol polyps and the other with non-cholesterol polyps. Clinical features such as gender, age, symptoms, size and number of polyps, the presence of a GB stone, the radiologically measured maximum diameter of the polyp by US and CT scanning, and the measurements of diameter from postoperative pathology were recorded for comparative analysis.

RESULTS: Fifteen of the 41 cases with cholesterol polyps (36.6%) were detected with US but not CT scanning, whereas all 18 non-cholesterol polyps were observed using both methods. In the cholesterol polyp group, the maximum measured diameter of the polyp was smaller by CT scan than by US. Consequently, the discrepancy between those two scanning measurements was greater than for the non-cholesterol polyp group.

CONCLUSION: The clinical signs indicative of a cholesterol polyp include: (1) a polyp observed by US but not observable by CT scanning, (2) a smaller diameter on the CT scan compared to US, and (3) a discrepancy in its maximum diameter between US and CT measurements. In addition, US and the CT scan had low accuracy in predicting the polyp diameter compared to that determined by postoperative pathology.

Key words: Cholesterol; Polyps; Gallbladder; Computed tomography; Ultrasonography

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INTRODUCTION

The development of radiological diagnostic tools such as ultrasonography (US) and computed tomography (CT) scanning has led to an increased frequency of the diagnosis of gallbladder (GB) lesions, such as GB polyps[1-3]. Because of the poor prognosis of GB malignancies, it is very important to distinguish between benign and malignant GB polyps so that malignant disease can be treated as soon as possible. Currently, clinical data such as the size and number of GB polyps and the age of the patient are used to help distinguish benign from malignant disease. Improved diagnostic methods are needed to differentiate between benign and malignant disease, and to determine which GB polyps

require surgical intervention[4-6].

Therefore, we evaluated clinical data to determine which factors would help distinguish benign from malignant GB polyps. We retrospectively analyzed the preoperative US and CT findings in patients with GB polyps and compared the results with their postoperative gross and microscopic findings.

MATERIALS AND METHODS

Fifty-nine patients who underwent laparoscopic cholecystectomy for a GB polyp of around 10 mm between January 2006 and August 2007 were enrolled in this study. We divided these patients into two groups, a cholesterol polyp group and a non-cholesterol polyp group. Data were collected for clinical features such as gender, age, symptoms, size and number of polyps, presence of a GB stone, radiological data from the preoperative US and CT scanning, and postoperative pathology data.

We compared the radiologically measured maximum diameters of the GB polyps obtained by one radiologist with the postoperatively obtained pathologic measurements of maximum diameters obtained by one pathologist. Results are reported as the mean ± standard deviation. For statistical analysis, a Chi-square, *t*-test and Fisher's Exact Test were used (SPSS version 15.0 software). A *P*-value < 0.05 was considered statistically significant.

RESULTS

Pathologic findings of the GB polyps

Of the 59 cases, 46 (78%) were pseudo-polyps such as a cholesterol polyp, inflammatory or hyperplastic polyp. Of these 46 pseudo-polyps, 41 (69.5%) were cholesterol polyps. True polyps were observed in 13 cases. Among the true polyps, 10 cases (17%) were adenomatous polyps and three cases (5.0%) were malignant.

Clinical findings of the GB polyps

Of the 59 patients, 37 patients were male and 22 were female. No difference was observed in gender ratios for the cholesterol polyp group (M:F = 25:16) and the non-cholesterol polyp group (M:F = 12:6 $P > 0.05$). The mean ages for each group were 40.98 ± 9.41 for the cholesterol polyp group and 48.39 ± 16.87 for the non-cholesterol polyp group. The former group had a significantly lower mean age ($P = 0.044$).

Five patients had presenting symptoms, which included three cases of indigestion, one case of right upper quadrant pain and discomfort and one case with fever suggesting cholecystitis. Three cases of cholesterol polyps (7.3%) and two cases of non-cholesterol polyps (11.1%) were associated with a GB stone. The factors associated with the metabolic syndrome were analyzed in the two groups. The mean body mass index (BMI) was 24.83 ± 2.92 kg/m^2 in the cholesterol polyp group and 23.80 ± 3.23 in the non-cholesterol polyp group; the mean homeostasis model assessment of insulin resistance (HOMA-IR) was 1.49 ± 1.85 and 1.26 ± 1.35 respectively, the mean HbA1c was 5.58 ± 0.74 (%) and 5.41 ± 0.23, respectively. The mean values for all these factors were slightly higher in the cholesterol polyp group but they were not statistically significant ($P > 0.05$) (Table 1).

Table 1 Clinical and laboratory characteristics of patients with gallbladder polyps (mean ± SD)

Histologic finding	Cholesterol polyp	Non cholesterol polyp	*P*-value
Age (yr)	40.98 ± 9.41	48.39 ±16.87	< 0.05
Sex (male/female)	25/16	12/6	0.677
Height (m)	1.6703 ± 0.09	1.65 ± 0.07	0.595
Weight (kg)	69.39 ± 13.26	64.85 ± 10.73	0.207
Cholelithiasis(case)	3	2	0.63
BMI (kg/m^2)	24.83 ± 2.92	23.80 ± 3.23	0.245
Fasting glucose (mg/dL)	97.05 ± 21.76	96.94 ± 15.0	0.985
Insulin (μIU/mL)	10.54 ± 3.63	9.47 ± 2.71	0.412
Homa-IR	1.49 ± 1.85	1.26 ± 1.35	0.64
HbA1c (%)	5.58 ± 0.74	5.41 ± 0.23	0.553
US size (mm)	9.95 ± 2.31	11.94 ± 4.02	< 0.05
CT size (mm)	6.77 ± 2.65	9.78 ± 5.19	< 0.05
Pathology size (mm)	4.83 ± 2.97	11.06 ± 5.11	< 0.01

Table 2 The number of polyps in cases with cholesterol and non-cholesterol polyps *n*(%)

		Cholesterol polyp	Non-cholesterol polyp	Total
Ultrasonographic findings ($P < 0.01$)				
Polyp number	Solitary	19 (46.3)	16 (88.8)	35 (59.3)
	Multiple	22 (53.7)	2 (11.1)	24 (40.7)
Total		41 (69.5)	18 (30.5)	59 (100.0)
Pathologic finding ($P < 0.01$)				
Polyp number	Solitary	11 (26.8)	15 (83.3)	26 (44.1)
	Multiple	30 (73.2)	3 (16.7)	33 (55.9)
Total		41 (69.5)	18 (30.5)	59 (100.0)

The number of GB polyps

In US, a single GB polyp was observed in 35 cases (59.3%) and multiple GB polyps were observed in 24 cases (40.7%). The proportion of multiple polyps in the cholesterol polyp group was 53.7% (22 out of 41 cases), which was higher than in the non-cholesterol polyp group (11.1%: 2 out of 18 cases, $P = 0.002$). For the postoperative pathology examinations, these proportions increased; 73.2% (30 out of 41 cases) and 16.7% (3 out of 18 cases), respectively ($P < 0.001$) (Table 2).

The discrepancy in maximum diameter between US and CT scanning

The preoperative mean maximum diameters measured by US in the cholesterol polyp group and the non-cholesterol polyp group were 9.95 ± 2.31 mm and 11.94 ± 4.02 mm, respectively, whereas for the CT scan they were 6.77 ± 2.65 mm and 9.78 ± 5.19 mm, respectively. The mean values for CT scanning tended to be smaller than for US.

The discrepancies in maximum diameters between US and CT scanning were 5.66 ± 3.87 mm in the

Table 3 The difference in the maximum polyp size between cholesterol and non-cholesterol polyps (mean ± SD)

	Cholesterol polyp	Non-cholesterol polyp	*P*-value
US-CT size difference (mm)	5.66 ± 3.87	2.17 ± 2.12	0
US size > CT size[1]	40/41	12/18	0.002
CT undetectable rate(%)	15/41 (36.6)	0/18 (0)	0.001
US-pathologic size difference (mm)	5.12 ± 3.42	0.89 ± 3.69	0

[1]Indicates number of patients having a larger size with US than CT.

Table 4 The correlation of size between cholesterol and non-cholesterol polyps

Correlation coefficients		Pathologic size	US size	CT size
Pathologic size	Non-cholesterol polyp	1	0.698[b]	0.746[b]
	Cholesterol polyp	1	0.181	0.324
US size	Non-cholesterol polyp	0.698[b]	1	0.925[d]
	Cholesterol polyp	0.181	1	0.427[c]
CT size	Non-cholesterol polyp	0.746[b]	0.925[d]	1
	Cholesterol polyp	0.324	0.427[c]	1

[b]$P < 0.01$ *vs* Pathologic size, [b]$P < 0.05$ *vs* US size.

cholesterol polyp group and 2.17 ± 2.12 mm in the non-cholesterol polyp group and this difference was statistically significant ($P < 0.01$). In 40 out of 41 cholesterol polyps (97.6%) and 12 out of 18 non-cholesterol polyps (66.6%) the diameters were smaller with CT scanning than with US ($P < 0.01$).

All 18 cases in the non-cholesterol polyp group were detected both by US and CT whereas 15 cases in the cholesterol polyp group among 41 (36.6%) were detected by US but not by CT scanning ($P < 0.01$, Table 3).

The discrepancy between preoperatively and postoperatively measured maximum polyp diameters

The pathologically measured mean maximum diameters were 4.83 ± 2.97 mm in the cholesterol polyp group and 11.06 ± 5.11 mm in the non-cholesterol polyp group ($P < 0.01$). When we compared these values with the preoperatively US measurements the discrepancies between preoperative and postoperative measurements were 5.12 ± 3.42 mm in the cholesterol polyps and 0.89 ± 3.69 mm in the non-cholesterol polyps ($P < 0.01$, Table 3).

The correlation between radiologically measured and pathologically measured polyp diameters

The non-cholesterol polyps showed statistically significant linear correlations between the actual maximum diameter from the pathology examination and the preoperative US measured diameter (correlation coefficient 0.698) and the CT measured diameter (correlation coefficient 0.746, $P < 0.01$). The cholesterol polyps, however, did not show this correlation ($P > 0.05$, Table 4).

DISCUSSION

The correct diagnosis of cholesterol polyps, which account for most of the pseudo-polyps of the GB, will help prevent unnecessary surgery and follow-up examinations. In this study, we attempted to characterize the features of the cholesterol polyp and determine accurate radiological predictive factors. Age is known to have a significant association with malignant polyps and is considered an independent risk factor[5-7]. This study also found that patients with non-cholesterol polyps had a higher mean age than did the patients in the cholesterol polyp group. Metabolic syndrome is also known to have a close relationship with the development of cholesterol polyps[2,8,9]. Although the patients with cholesterol polyps had higher levels of the BMI, HOMA-IR, and HbA1c, the differences did not reach statistical significance. The sample size might have been too small to detect any differences.

Regarding the number of polyps in the GB, it is also known that a single polyp is more likely to be a malignant polyp, which prompts the need for more aggressive interventions when a single polyp is identified compared to multiple polyps[5,10]. We found a similar tendency among our study population. The patients with cholesterol polyps more frequently had multiple polyps than did the patients with non-cholesterol polyps. It is well known that the size of a GB polyp is related to malignancy. Many studies have reported that a GB polyp ⩾ 10 mm has a high risk of being a malignancy and this size is one of the criteria for surgical intervention[4,11-13]. However, we also have observed that a benign polyp, such as a cholesterol polyp, can be as large as 10 mm. Therefore, size may not afford an accurate distinction between benign and malignant polyps[14,15].

In cases with a cholesterol polyp, we observed discrepancies in the size and number of polyps between the preoperative radiological measurements and the postoperative pathology measurements. The postoperative pathology of cholesterol polyps had a smaller size and higher multiplicity than did the preoperative radiological studies. A possible explanation for this finding is that the cholesterol polyp might be damaged during the laparoscopic cholecystectomy or during handling of the GB tissue considering its histological fragility and weakness. The cholesterol polyp had low correlation coefficients in the comparisons between the pathologically measured size after surgery and the radiologically measured sizes prior to surgery. Therefore, the radiological studies are limited in obtaining the correct measurements for cholesterol polyps.

In conclusion, the cholesterol polyp has a tendency to be observed more frequently in younger patients and has higher multiplicity. The predictive signs for a cholesterol polyp, a benign tumor, include: a polyp observable by US but not CT scanning, a discrepancy ⩾ 5 mm in the maximum diameter of the polyp between the US and CT measurements, a smaller diameter of the polyp by CT compared to US, and a low correlation between the diameter of the polyp from postoperative pathology and

the preoperative radiological measurements.

We suggest that it would be more efficient to make a flexible and tailored follow up plan or treatment plan for GB polyps based on the above mentioned signs rather than fixed or inflexible guidelines. In addition, the preoperative radiological measurement of diameter is of predictive value for the postoperatively measured actual diameter only for non-cholesterol polyps. For cholesterol polyps, the preoperative radiological measurements are limited in their prediction of postoperative pathology diameter. Therefore, methods that are more accurate for the preoperative diagnosis of cholesterol polyps are needed.

COMMENTS

Background

The development of radiological diagnostic tools has led to an increased frequency of the diagnosis of gallbladder (GB) lesions, such as GB polyps.

Research frontiers

It is very important to distinguish between benign and malignant GB polyps because of the poor prognosis of GB malignancies. Improved diagnostic methods are needed to differentiate benign from malignant disease, and to determine which GB polyps require surgical intervention.

Innovation and breakthroughs

The predictive signs for a cholesterol polyp, the most common benign GB polyp, include: a polyp observable by ultrasonography (US) but not computed tomography (CT) scanning, a discrepancy $\geqslant$ 5 mm in the maximum diameter of the polyp between US and CT measurements, a smaller diameter of the polyp by CT than by US.

Applications

This study should help to distinguish a cholesterol polyp from a non-cholesterol polyp. It would be more efficient to make a flexible and tailored follow up plan or treatment plan for GB polyps.

Peer review

The concept of this study is useful.

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