

Gallbladder polyps: Epidemiology, natural history and management

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Polypoid lesions of the gallbladder affect approximately 5% of the adult population. Most affected individuals are asymptomatic, and their gallbladder polyps are detected during abdominal ultrasonography performed for unrelated conditions. Although the majority of gallbladder polyps are benign, most commonly cholesterol polyps, malignant transformation is a concern. The differentiation of benign from malignant lesions can be challenging. Several features, including patient age, polyp size and number, and rapid growth of polyps, are important discriminating features between benign and malignant polyps. Based on the evidence highlighted in this review, the authors recommend resection in symptomatic patients, as well as in asymptomatic individuals over 50 years of age, or those whose polyps are solitary, greater than 10 mm in diameter, or associated with gallstones or polyp growth on serial ultrasonography. Novel imaging techniques, including endoscopic ultrasonography and enhanced computed tomography, may aid in the differential diagnosis of these lesions and permit expectant management.

Key Words: Gallbladder; Gallbladder neoplasms; Gallbladder polyps; Gallstones; Surgery; Ultrasonography

Les polypes vésiculaires : L'épidémiologie, l'évolution naturelle et la prise en charge

RÉSUMÉ : Les lésions polypoïdes de la vésicule biliaire touchent environ 5 % de la population adulte. La plupart des personnes atteintes sont asymptomatiques, et les polypes vésiculaires sont décelés pendant une échographie abdominale exécutée pour des troubles non reliés. Bien que la majorité des polypes vésiculaires soient bénins, et qu'il s'agisse surtout de polypes cholestéroliques, la transformation maligne demeure une préoccupation. La différenciation entre les lésions bénignes et malignes peut poser un défi. Plusieurs caractéristiques, y compris l'âge du patient, la taille et le nombre des polypes et leur rapidité de croissance, constituent des facteurs discriminatoires importants entre les polypes bénins et malins. D'après les observations soulignées dans la présente étude, les auteurs recommandent la résection chez les patients symptomatiques, chez les patients asymptomatiques de plus de 50 ans et chez ceux dont les polypes sont solitaires, d'un diamètre supérieur à 10 mm ou associés à des calculs vésiculaires ou à une croissance polypoïde à l'échographie sérielle. Les nouvelles techniques d'imagerie, y compris l'échographie endoscopique et la tomomodensitométrie améliorée, peuvent contribuer au diagnostic différentiel de ces lésions et permettre une prise en charge de surveillance.

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Over the past 20 years, the increased availability and improved image quality of abdominal ultrasonography have led to a dramatic increase in the detection of abnormalities of the biliary tree, including polypoid lesions of the gallbladder (PLG). Defined sonographically as immobile echoes protruding from the gallbladder wall into the lumen, PLG comprise several histopathological entities. In 1970, Christensen and Ishak (1) proposed a simple classification of benign PLG that allowed separation of neoplastic from non-neoplastic conditions. Based on an analysis of 180 cases of benign gallbladder polyps, the authors classified benign PLG into pseudotumours, including, most commonly, cholesterol polyps, adenomyomatosis and inflammatory polyps, and true tumours, including adenomas, leiomyomas and lipomas. Distinguishing these benign PLG from malignant and potentially malignant lesions is a major diagnostic dilemma with important clinical implications. The present review highlights the epidemiology, modes of diagnosis and natural history of gallbladder polyps in the adult population. The differentiation of benign from malignant PLG is discussed, and evidence-based recommendations for the management of these lesions are provided.

PREVALENCE

The prevalence of PLG has been estimated to range from 0.03% to 9.5% of the adult population, depending on the type of study and the population of interest (2). Many of the large population studies have been performed in Asian populations, often as part of mass screening programs for unrelated conditions. In an ultrasonographic study of 3647 Chinese subjects, gallbladder abnormalities were reported in 701 subjects (19.2%) (3). Specifically, PLG were identified in 243 subjects (6.7%) – a prevalence similar to that of gallstones in this study (7.8%). Further analysis of these data, after excluding subjects who had previously undergone cholecystectomy, those with coexistent gallstones and polyps, and those with unsatisfactory sonographic examinations, revealed an overall frequency of PLG of 6.9% (3) (Table 1). Similar large Japanese studies have reported prevalence rates of 2.6% (4) and 5.6% (5). Gallbladder polyps were more common among males (6.3%) than females (3.5%, $P < 0.001$). The largest study to date assessing ultrasonography in asymptomatic patients was recently reported by Okamoto et al (6). Among 194,767 Japanese participants, gallstones were identified in 4.1%, whereas gallbladder polyps were found in 5.6%.

Prevalence figures have also been reported from studies of European populations (Table 1). An ultrasonographic-based study in Denmark reported a prevalence of gallbladder polyps similar to that found in the Asian populations (4.6% of men and 4.3% of women) (7), and a study based in Germany reported a prevalence of 1.5% (8). Interestingly, a study from India reported a prevalence of only 0.32% (9). Thus, the incidence of gallbladder polyps seems to vary widely among reports and appears to be related to the population examined, as well as to the study design (Table 1).

TABLE 1
The prevalence of polypoid lesions of the gallbladder in adults

Author, year (reference)	Patient population	Sample	Prevalence (%)
Okamoto et al, 1999 (6)	Japanese	194,767	5.6
Segawa et al, 1992 (5)	Japanese	21,771	5.6
Moriguchi et al, 1996 (4)	Japanese	4343	2.6
Shinchi et al, 1994 (14)	Japanese (males only)	2739	5.3
Chen et al, 1997 (3)	Chinese	3647	6.9
Heyder et al, 1990 (8)	German	14,841	1.5
Jorgensen et al, 1990 (7)	Danish	3608	4.8
Collett et al, 1998 (10)	New Zealander (diabetics and controls)	1254	6.7
Pandey et al, 1996 (9)	Indian	610	0.32

RISK FACTORS FOR GALLBLADDER POLYPS

Many studies have attempted to determine individual risk factors that predispose patients to the formation of PLG. The impact of demographic factors such as patient age and sex have been variable. Although most reports have documented the highest prevalence of gallbladder polyps in the third to fifth decades of life, consistent associations with patient age have not been reported (3,5,7). For example, using multivariate analysis, Chen et al (3) failed to show an effect of age on the development of PLG in Chinese subjects. Other investigators have found similar findings (7). Conversely, Segawa and colleagues (5) reported a significant age-dependent prevalence of PLG in Japanese men and in women under the age of 70 years, with the highest prevalence occurring in 40- to 50-year-old men (5). The impact of sex on the formation of PLG also has been discordant across studies. Some reports find that gallbladder polyps are more common in males (3,5,8,10), whereas others note an increased frequency in females (11-13) or no difference between the sexes (4,7). Overall, PLG seem to predominate in males, unlike gallstone disease. In the largest screening study to date involving 194,767 Japanese participants, Okamoto et al reported PLG in 6.9% of males and 4.5% of females (6).

Significant effects of other demographic variables on the prevalence of PLG have not been identified. Although obesity has occasionally been associated with the development of PLG (5), other demographic factors such as physical activity, parity, use of exogenous female hormones and alcohol consumption appear to be less important. Jorgensen and Jensen (7) reported that smoking has a protective effect in men only, but other investigators have not reproduced their findings (14).

Similarly, there is no evidence of a relationship between PLG and biochemical parameters such as plasma lipid profile (3), hepatitis B virus carrier status (3) and liver function

(3). Chen et al (3) found that glucose intolerance, but not overt diabetes mellitus, is a risk factor for the development of gallbladder polyps. They suggested that gallbladder dysmotility due to hyperglycemia may predispose glucose-intolerant patients to the formation of gallbladder polyps. However, because of the absence of a similar finding in the overtly diabetic patients in their study and in other prevalence studies (7,10,14), the validity of this association is questioned.

As is evident from the above discussion, the lack of any consistent association between PLG and age, sex, body mass index and diabetes mellitus does not resemble the risk factor profile of gallstones (15). The literature investigating an association between gallbladder polyps and stones is conflicting. Wolpers (16) followed 181 patients with ultrasonographically diagnosed PLG who were free of gallstones for a mean of 9.5 years. Patients with PLG had no increase in the rate of development of stones compared with a control group comprising people who were free of polyps. Similarly, in their sonographic study of 3608 asymptomatic individuals from Denmark, Jorgensen and Jensen (7) found only three gallbladders containing both stones and polyps. The authors suggested that a negative association between gallstones and PLG may be due to a destructive mechanical effect of mobile stones on gallbladder polyps or to difficulties in identifying PLG sonographically in the presence of gallstones (7). Others, however, have found a positive association between gallbladder polyps and stones (17).

Gallbladder polyps also occur in patients with congenital gastrointestinal syndromes associated with polyp formation in the intestines, including the Peutz-Jeghers syndrome (18,19) and Gardner's syndrome (20,21). The frequency of gallbladder polyps may also be increased in patients with HIV infection. In a study of 83 HIV-positive patients who underwent endoscopic retrograde cholangiopancreatography for the investigation of cholestatic liver enzymes or abdominal pain, an admittedly selected population, 15 patients (18.1%) were found to have intraluminal polyps (22).

CLINICAL SIGNIFICANCE OF GALLBLADDER POLYPS

The frequency of symptoms in patients with PLG is difficult to evaluate due to inadequacies of studies in the available literature. Symptoms were not assessed in most of the population-based, ultrasonographic prevalence studies. In a study evaluating the natural history of PLG diagnosed via cholecystography, only 6% of patients were thought to have symptoms referable to the gallbladder (23). Surgical studies, on the other hand, have found a higher frequency of symptoms in patients with documented PLG, likely due to selection bias. For example, Terzi et al (24) reported symptoms in 91% of 74 patients who had undergone cholecystectomy for benign PLG. The most frequently cited complaints included right upper quadrant or epigastric pain (98%), nausea and vomiting (51%), and dyspepsia (26%). Right upper quadrant tenderness was the most common physical

TABLE 2
Factors predictive of malignancy in patients with polypoid lesions of the gallbladder

Risk factor	Reference(s)
Lesion >10 mm	13,24,25,30-33,35,59
Solitary lesion	30,31,60
Age >50-60 years	24,25,31,32,60
Polyp growth	33
Concurrent gallstones	25,31,36
Adenomatous polyps	32,38-41
Sessile lesions	33-35
Gallbladder wall thickening	35

finding (61%). There were no significant differences in symptoms between patients with benign PLG and those with malignant PLG, a finding that has been confirmed in other studies (25). Gallbladder polyps have also been implicated in cases of obstructive jaundice (26), acalculous cholecystitis (27) and massive hemobilia (28). They may increase the risk of acute pancreatitis (29).

One of the major concerns regarding gallbladder polyps is the differentiation of benign from malignant masses. Although the majority of PLG are benign (approximately 75%, depending on the series), differentiation from malignant lesions can be challenging. Because carcinoma of the gallbladder usually presents late and has a dismal prognosis, lesions must be detected early, when still confined to the mucosa, to affect the prognosis. As a result, a wealth of literature has emerged in an attempt to identify characteristics that increase the likelihood of malignancy in PLG (Table 2). Several characteristics, including the size, number and shape of the polyp(s), and the age of the patient, have emerged as important discriminating features.

For example, in a study of 74 patients with resected gallbladders and small polyps (smaller than 2.0 cm in diameter), cholesterol polyps were found in 44 cases (59%), adenomas in five cases (7%), cancers in six cases (8%), and other conditions, including hyperplastic polyps and adenomyomatosis, in 19 cases (26%) (30). Whereas the mean diameters of cholesterol polyps and adenomas were 3.7 mm and 6.0 mm, respectively, the mean diameter of the carcinomas was 10.8 mm. Almost all (97%) of the cholesterol polyps were less than 10 mm in diameter, and 82% were smaller than 5 mm. On the contrary, only 6% of the adenomas or carcinomas were less than 5 mm in diameter (30). Importantly, the number of lesions in each group also differed. Whereas approximately 80% of neoplastic lesions were solitary (mean number of adenomas 1.40; mean number of carcinomas 1.16), cholesterol polyps were more commonly multiple (50%; mean 3.09). All of the cases of four or more polyps in this series were cholesterol polyps. Over 50% of polyps exceeding 10 mm were neoplastic. In those

with fewer than three polyps (5 to 10 mm in diameter), the frequency of neoplasm was 37% (30). Other investigators have corroborated the importance of polyp number as a discriminating feature (30-32). For example, in an analysis of 172 patients with histologically confirmed PLG, Yang and colleagues (31) reported that all of the 13 malignant PLG were solitary, whereas none of the 86 patients with multiple PLG harboured a malignancy (31).

Several other reports support the importance of polyp size in differentiating benign from malignant lesions (25,32,33). Koga et al (25) reported a retrospective study of 411 patients who had undergone cholecystectomy; 32 patients had benign polyps and eight patients had malignancies. In that study, 94% of the benign PLG were less than 10 mm in diameter, whereas 88% of the cancers exceeded this diameter. Similarly, in 72 patients who had undergone resective surgery for PLG, Kubota and colleagues (33) reported that 61% of benign lesions were less than 10 mm in diameter compared with only 12% of cancers (33). The size of carcinomatous PLG also appears to correlate with the extent of tumour invasion (24,25,32,33).

Several other features have emerged as important discriminators in the diagnosis of malignant gallbladder polyps, including patient age. In the study by Koga et al (25), 69% of those with benign lesions were under 60 years of age, whereas 75% with malignancies were over 60 years of age (25). Similarly, Terzi and colleagues (24) reported that only 27% of patients with benign PLG versus 73% of patients with malignant PLG were over 60 years of age. Yang et al (31), using a lower age cutoff, reported malignant PLG in 21% of 56 patients over 50 years of age, whereas benign lesions were found in 115 of 116 patients (99%) under 50 years of age. Others have reported an increased risk of malignancy in PLG that are sessile (33,34), associated with wall thickening (35), rapidly growing (33), and/or associated with gallstones (25,31,36).

NATURAL HISTORY OF PLG

A major concern in the management of the patient with PLG is the potential for malignant transformation, although the relationship between gallbladder polyps and cancer is controversial. Aldridge and Bismuth (37) and others have argued that there is a polyp-cancer sequence, similar to that in the pathogenesis of colorectal carcinoma. Adenomatous polyps appear to have the highest risk of malignant transformation. In a study of 300 randomly selected gallbladders at cholecystectomy, 5% were found to harbour sessile adenomas (38). Furthermore, 19% of these cases exhibited small foci of moderate cellular atypia, and in 31% of these cases, carcinoembryonic antigen was positive (38). Kozuka et al (39) reviewed the histology of 1605 resected gallbladders and found 11 benign adenomas, seven adenomas showing malignant change and 79 invasive carcinomas. Supporting evidence for an adenoma-adenocarcinoma sequence from this study included the correlation between the size of the lesion and malignant change, similar to that described in colorectal carcinoma, as well as the

discovery of adenomatous components in all of the in situ carcinomas and 19% of the invasive carcinomas (39). There have also been several case reports of gallbladder polyps developing into gallbladder cancer, and adenomatous polyps containing carcinoma in situ (32,38,40,41). Further, patients with gastrointestinal polyp syndromes have been reported to develop gallbladder polyps and adenocarcinoma (18,20,42). Although gallbladder adenomas appear to carry the highest malignant potential, other seemingly innocent lesions have been reported to undergo malignant transformation. For example, adenomyomatosis of the gallbladder, which is extension of the mucosa into and through a thickened muscular wall, has historically been considered to be an innocuous lesion. Recently, however, several cases of gallbladder cancer have been described in areas of adenomyomatosis (43,44). Similarly, carcinoma in situ has been reported to occur in patients with cholesterol polyps (45,46).

Few studies have prospectively investigated the natural history of unresected gallbladder polyps. Eelkema et al (23) reported no cases of gallbladder cancer in 113 patients followed-up for 15 years after the diagnosis of PLG on cholecystography. This study was limited, however, by the poor sensitivity of cholecystography in detecting PLG and, more importantly, by the loss to follow-up of half of the patients who were originally investigated. Moriguchi et al (4) reported a similarly benign progression of gallbladder polyps. In that study, 109 patients with PLG were followed-up with serial ultrasounds every six to 12 months for at least five years. Gallbladder cancer was found in only one patient, but its location was different from that of the pre-existing polyp. The size of most (84.5%) of the lesions did not change during the observation period. Only 16.7% of the largest lesions (those larger than 10 mm in diameter on the original ultrasound) enlarged (4). Shinkai and colleagues (30) also reported no significant changes in the number or overall average size of cholesterol polyps in 60 patients followed-up sonographically for a mean of 22 months. During the follow-up period, nine patients underwent cholecystectomies; seven had histologically confirmed cholesterol polyps, one an adenoma and one a solitary dysplastic lesion 2 mm in diameter. No patient developed adenocarcinoma of the gallbladder (30). A prospective German study, employing ultrasonographic examination of the gallbladder over a three-year period in 14,841 consecutive patients, revealed polypoid changes in 224 patients (1.5%) (8). Of these, 95% were thought to be cholesterol polyps and the remainder were classified as benign lesions of uncertain etiology. During a short observation time of nine months, only 6.5% of the patients with cholesterol polyps had at least a 5 mm increase in the diameter of their polyps (8). A total of 21 patients suspected of having cholesterol polyps were operated on during this time. The diagnosis was confirmed in 17 patients; two had chronic cholecystitis and the remainder had other benign nonpolypoid lesions. Of the 12 patients with benign polypoid lesions of uncertain etiology at the original ultrasonogram,

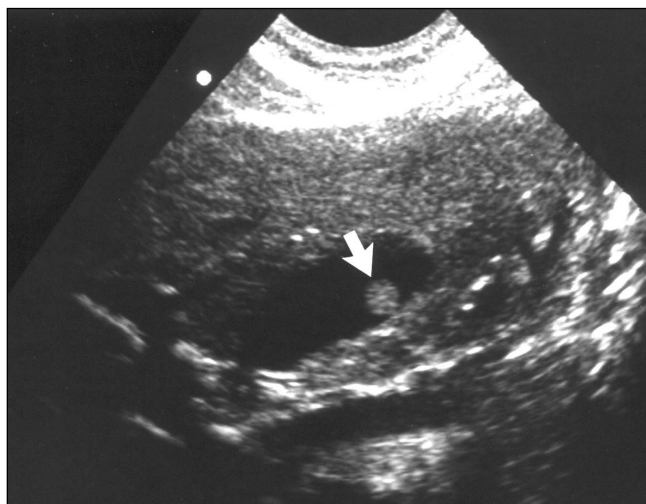


Figure 1) Abdominal ultrasound showing a polypoid lesion of the gallbladder (arrow) with classic sonographic features, including hyperechogenicity and the absence of an acoustic shadow

six had cholecystectomies during the follow-up period. Surgical specimens revealed adenomas in two patients, gallbladder carcinoma in one, metastatic melanoma in one, adenomyomatosis in one and tissue heterotopy in one (8).

Not all seemingly benign PLG, however, have demonstrated such slow growth. For example, Ukai et al (47) reported a case of a cholesterol polyp that increased in diameter by 40% over a 10-month period. Such rapid growth has been suggested as an indication for surgery in patients with gallbladder polyps due to the concern of malignant transformation.

RADIOLOGICAL ASSESSMENT OF GALLBLADDER POLYPS

The ultrasonographic diagnosis of PLG requires the identification of hyperechoic material protruding into the gallbladder lumen (Figures 1 and 2). These echoes are characterized by the absence of shift with positional change; they may or may not cast an acoustic shadow (7,15). The sensitivity of ultrasound in detecting PLG ranges from 32% to 90% (31,48). Gallstones notoriously decrease ultrasound sensitivity; in patients without gallstones, the sensitivity approaches 99% (31). The specificity of ultrasound has been reported to be 94% (31). Other lesions, including sludge, chronic cholecystitis, heterotopic tissue, gallbladder carcinomas and metastatic disease, can be misdiagnosed as benign PLG (8,31,49). The correlation between ultrasonographic and pathological findings in the assessment of PLG has not been clearly defined. Some studies have found a poor correlation between ultrasound findings and pathology (50). Kubota et al (33) reported accuracies of 89%, 57% and 72% for preoperative sonographic diagnoses of cholesterol polyps, adenomas and carcinomas, respectively, compared with histological findings. In one study of 34 patients who underwent a cholecystectomy for PLG, only 11 had macroscopic and histopatholog-

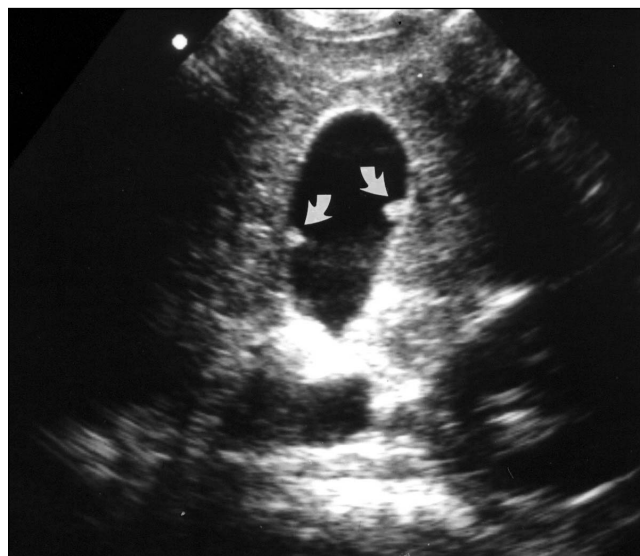


Figure 2) Abdominal ultrasound in a patient with two hyperechoic polypoid lesions of the gallbladder (arrows). The gallbladder is otherwise normal

ically proven PLG (thus, a sensitivity of 32%) (48). The size of cholesterol polyps may also be overestimated by ultrasonography (50).

In the differentiation of benign from malignant lesions, recent studies have suggested that colour Doppler ultrasonography in combination with conventional ultrasound may be useful in the diagnosis of PLG (51,52). Preliminary reports also suggest that ultrasound-guided percutaneous transhepatic fine needle aspiration is safe and accurate in the assessment of PLG, especially cholesterol polyps (53). Ultrasonographic angiography may also be helpful in differentiating benign from malignant lesions (54).

Computed tomography (CT) scanning can also aid in the diagnosis of gallbladder polyps. Unenhanced CT scans, however, can miss up to 60% of lesions that were initially visualized by ultrasound (55). A combined approach of unenhanced and enhanced CT scanning in the diagnosis of PLG has been reported to provide an overall sensitivity of 88%, a specificity of 87%, a positive predictive value of 88%, a negative predictive value of 87% and an overall accuracy of 87% (55).

Recently, endoscopic ultrasonography (EUS) has been reported to be superior to transabdominal ultrasonography in differentiating PLG (56,57). Using EUS, a tiny echogenic spot or aggregation of echogenic spots and multiple microcysts, or a comet tail artifact are pathognomonic for cholesterol polyps and adenomyomatosis, respectively (56). In a recent surgical series, EUS differentiated PLG more precisely than conventional ultrasonography (97% compared with 76%) (57). Contrast enhancement further increases the accuracy of EUS, particularly the depth of tumour invasion (58). For example, a recent series of 28 patients revealed accurate prediction of the depth of tumour invasion in 93% by EUS with contrast enhancement compared with 79% by EUS alone (58).

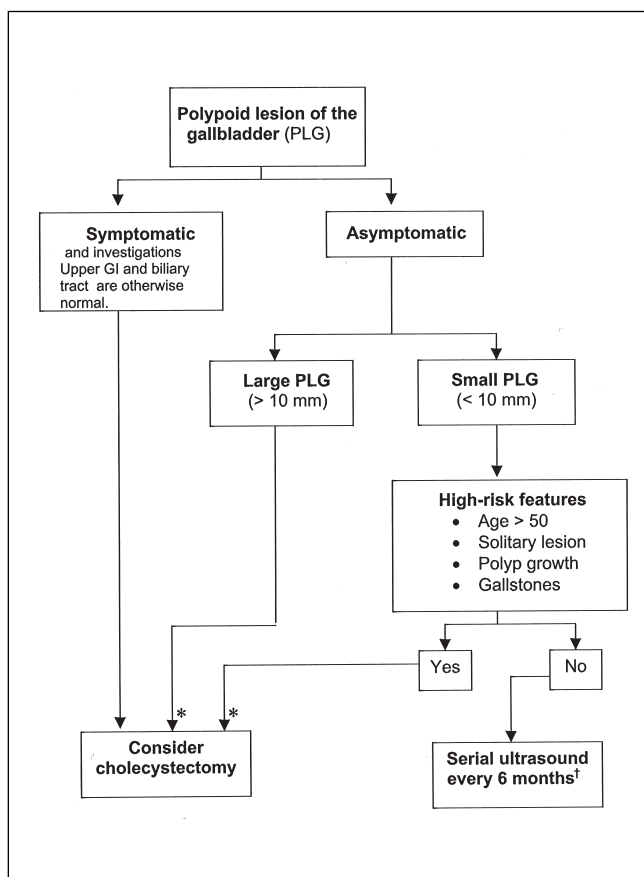


Figure 3) Recommended strategy for the management of polypoid lesions of the gallbladder (PLG) in adults. *Consider use of other modalities such as endoscopic ultrasound to assess malignant potential; †The frequency of ultrasounds after stability over two serial six-month examinations should be determined on a case basis depending on existing risk factors. GI Gastrointestinal. Data from reference 36

CLINICAL MANAGEMENT OF GALLBLADDER POLYPS

The management of patients with PLG requires the resolution of three key questions:

- Which patients with PLG should undergo resection?
- If a resection is planned, what is the optimal surgical approach?
- How often should lesions be monitored if surgical resection is deemed unnecessary?

In a recent review of the literature, Boulton and Adams (36) suggested that all patients with gallbladder polyps who are symptomatic, have lesions greater than 10 mm in diameter or have complicating factors that increase the risk of malignancy (age over 50 years or concurrent gallstones) should undergo resection. According to Boulton and Adams (36), all others should be followed-up cautiously every three to six months with repeat abdominal ultrasounds. Generally, this seems to be the consensus of several recent studies (10,13,25,31,33,35,59-61). These suggestions are based on the finding that most benign polyps are less

TABLE 3
Important features of polypoid lesions of the gallbladder

Pathology	Most commonly (approximately two-thirds) cholesterol polyps. Other lesions include adenomas, inflammatory polyps, leiomyomas and gallbladder adenocarcinoma.
Prevalence	0.32% to 6.9%.
Risk factors	No consistent patient profile. Advancing age may be important, but obesity, female sex and diabetes mellitus (the typical gallstone phenotype) are unimportant.
Symptoms	Most are asymptomatic, but symptoms include right upper quadrant or epigastric pain, nausea and vomiting.
Ultrasonography	Immobile, hyperechoic shadows protruding into the gallbladder lumen. Sensitivity ranges from 32% to 90%, with a specificity of up to 94% (sensitivity is decreased in the presence of gallstones). Endoscopic ultrasonography appears to be more sensitive and may have a role in difficult cases.
Natural history	The majority do not grow; however, rapid growth has been reported. Overall, the malignant potential appears low, but several factors (Table 2) increase the risk of malignant transformation.
Treatment	Consider cholecystectomy in those with symptoms, large lesions (>10 mm in diameter) or features associated with malignancy (Figure 3).

than 10 mm in diameter, whereas malignant polyps usually exceed this diameter (13,24,25,30-33,35,59). Others recommend cholecystectomy for all patients with gallbladder polyps, independent of size or symptoms (62), while some suggest resection of small lesions (less than 10 mm in diameter) if the lesions are single (30,31,60), sessile (35,38), rapidly growing (61) or associated with wall thickening (35), or if the patient is symptomatic or over the age of 60 years (25,31,60).

Based on the available evidence, we agree with the recommendations of Boulton and Adams (36), with one exception (Figure 3). We suggest that the indications for resection in asymptomatic patients with small polyps (less than 10 mm in diameter) be expanded to include those with other features that increase the risk of malignancy. In addition to older age (over 50 years) and the presence of gallstones, additional high risk features include the presence of solitary polyps or polyp growth. The safety of laparoscopic cholecystectomy (63), as well as the dismal prognosis of gallbladder carcinoma discovered late in its course (less than 5% five-year survival for stage III and IV tumours), favour this approach. The roles of novel imaging

and diagnostic techniques such as EUS, enhanced CT scanning and fine needle aspiration need to be further defined before their incorporation into the standard management of these lesions.

The management of PLG once a decision has been made for resection is also of some debate. In a study by Kubota et al (33), seven of eight early-stage cancers (confined to the mucosa and muscularis propria) were less than 18 mm in diameter, whereas all advanced cancers exceeded this dimension. Thus, the authors recommended laparoscopic cholecystectomy for lesions less than 18 mm in diameter, but a second-look operation if the tumour is found to invade the subserosa or beyond on histology. Due to the higher potential of underlying malignancy, the authors recommended that all lesions greater than 18 mm in diameter be removed by extended open cholecystectomy (with partial liver resection), allowing for possible lymph node removal (33). Conversely, others have suggested open resection in all cases in which malignancy is suspected based on preoperative evaluation (64) because laparoscopic cholecystectomy in those with unsuspected gallbladder cancer has been reported to lead to a poor prognosis from recurrences, both locally and at the port site (65,66). Unfortunately, trials comparing these surgical approaches are not available. Thus, the ideal surgical approach to PLG with a suspicion of malignancy is unsettled.

The frequency of ultrasonographic monitoring of patients with unresected PLG is also unclear. Boulton and Adams (36) suggested an interval of every three to six months, while others feel that decisions should be made on a case by

case basis, adjusted by the risk factors of each individual patient. Several studies have followed low risk lesions for several years without significant adverse consequences or marked change in the size and risk profiles of the lesions (4,10). Rapid, marked growth of lesions, however, can be missed in intervals as short as four to 12 months (47).

CONCLUSIONS

Gallbladder polyps are common in the adult population. The majority of PLG are cholesterol polyps; thus, most PLG have a low malignant potential. We suggest resection of polyps in patients with compatible symptoms, including biliary-type pain and dyspepsia. In addition, asymptomatic individuals older than 50 years of age or those whose polyps are solitary, greater than 10 mm in size, associated with gallstones, or growth on serial ultrasonography, should undergo resection (Table 3). The true malignant risk that is conferred by lesions being sessile or associated with wall thickening remains unclear. Further studies are necessary to define the impact of these possible risk factors before modification of the existing resection criteria should be considered. Furthermore, the role of novel diagnostic techniques, such as enhanced CT scanning, EUS and percutaneous fine needle aspiration, in assessing gallbladder polyps needs to be defined before their broad dissemination in the management of these lesions. Larger prospective studies of diagnosis and treatment must also be carried out in European and North American populations that have a lower risk of gallbladder cancer than most Asian countries because extrapolation of data from the latter may not be appropriate.

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