Recommendation and Guideline

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Interpretation, Reporting, Imaging-Based Workups, and Surveillance of Incidentally Detected Gallbladder Polyps and Gallbladder Wall Thickening: 2025 Recommendations From the Korean Society of Abdominal Radiology

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Incidentally detected gallbladder polyps (GBPs) and gallbladder wall thickening (GBWT) are frequently encountered in clinical practice. However, characterizing GBPs and GBWT in asymptomatic patients can be challenging and may result in overtreatment, including unnecessary follow-ups or surgeries. The Korean Society of Abdominal Radiology (KSAR) Clinical Practice Guideline Committee has developed expert recommendations that focus on standardized imaging interpretation and follow-up strategies for both GBPs and GBWT, with support from the Korean Society of Radiology and KSAR. These guidelines, which address 24 key questions, aim to standardize the approach for the interpretation of imaging findings, reporting, imaging-based workups, and surveillance of incidentally detected GBPs and GBWT. This recommendation promotes evidence-based practice, facilitates communication between radiologists and referring physicians, and reduces unnecessary interventions.

Keywords: Gallbladder; Gallbladder polyp; Gallbladder wall thickening; Gallbladder cancer; Guideline; Recommendation; Consensus

INTRODUCTION

Incidentally detected gallbladder polyps (GBPs) on ultrasound (US) are prevalent and have been reported to be present in approximately 3.3%–5.5% of the general population [1,2]. The majority of GBPs are benign; however, some are neoplastic polyps that can be malignant or are precursors of malignant tumors. Distinguishing neoplastic

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Korean Journal of Radiology
KJR

from non-neoplastic GBPs on imaging poses a substantial challenge [3,4]; therefore, most patients with GBPs undergo follow-up, and cholecystectomy is recommended if the GBP is 10 mm or larger [5,6]. However, recent studies have reported that the majority of resected GBPs are benign [7,8], and the malignancy potential remains low in GBPs ≥10 mm [9]. Therefore, unnecessary cholecystectomies or follow-up examinations may occur more frequently than previously recognized. Furthermore, some studies have reported that inaccurate US findings might lead to unnecessary surgery [4,10,11], highlighting the importance of expert guidelines related to US performance and interpretation. GBPs are often accompanied by gallbladder wall thickening (GBWT). When GBWT is observed, surveillance or further diagnostic procedures are typically required. Consequently, there is a clear need for a standardized approach to the interpretation, reporting, and management of imaging findings in both GBPs and GBWT. Recently, several academic societies have published guidelines for GBPs to address these limitations [12-14]. In response to this trend, there is a recognized need for expert recommendations regarding the management of incidentally detected GBPs and GBWT in Korea. With support from the Korean Society of Radiology (KSR) and the Korean Society of Abdominal Radiology (KSAR), the Clinical Practice Guideline Committee of the KSAR developed guidelines for GBPs and GBWT. These guidelines, postulated between May 2023 and May 2024, address 24 key questions (KQs). The aim was to standardize the interpretation and reporting of imaging findings, as well as imaging-based workups and surveillance for incidentally detected GBPs and GBWT. This recommendation also aimed to enhance communication and understanding between radiologists and referring physicians regarding imaging findings and management recommendations for patients.

Methods of Development

These guidelines are primarily intended for radiologists who perform imaging examinations for GBPs and GBWT. The target population comprised patients with incidentally detected GBPs or GBWT. The present recommendation does not address symptomatic GBPs and GBWT or patients with a specific risk of gallbladder cancer (GBC), such as those with primary sclerosing cholangitis (PSC) or elevated tumor markers such as carbohydrate antigen 19-9 (CA 19-9).

Key Question Development

Twelve board-certified abdominal radiologists from eight academic institutions in South Korea participated as members of the Development Committee. All participants were regular members of the KSAR and KSR and were part of the clinical practice guidelines committee of the KSAR. Areas of expertise included US, computed tomography (CT), and magnetic resonance imaging (MRI) for GBP, GBWT, and GBC. Following the initial inaugural meeting, monthly meetings were conducted throughout the guideline development period.

All participants suggested keywords, including diseases, imaging modalities, mimickers, and current guidelines associated with GBPs and GBWT, through an asynchronous online brainstorming process. Subsequently, KQs addressing imaging features, imaging modalities, epidemiology, risk, and management were drafted based on these keywords through discussions among committee members. Concurrently, KQ lists from existing clinical practice guidelines were reviewed and incorporated as necessary. The drafted KQs were then reorganized as closely as possible with the population, intervention, comparison, and outcome (PICO) principles, and the KQs were finalized through discussions among all Development Committee members.

Literature Research

A comprehensive literature search was conducted on June 20, 2023, using search terms developed through collaborative discussions among methodology experts and guideline Development Committee members responsible for each KQ. The databases used were MEDLINE (PubMed), EMBASE, Cochrane, and KoreaMed. Methodology experts and committee members overseeing individual KQs were involved in all search processes. Specific search queries are detailed in Supplementary Tables 1-8. All members evaluated the eligibility of the articles based on language (English or Korean), sufficiency of details (excluding conference proceedings, reviews, case reports, and pictorials), and relevance to the topic.

Quality Assessment of Literature

The quality of the reference literature obtained from the literature search was evaluated by members of the KSAR Clinical Practice Guideline Committee. The Quality Assessment of Diagnostic Accuracy Studies-2 (QUADAS-2) tool was used for diagnostic studies, whereas the Risk of

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Bias Assessment Tool for Non-randomized Studies (ROBANS) was used for non-randomized studies.

Development of Recommendation Statements for Key Questions

Recommendation statements for the KQs were formulated based on the literature. The drafted statements were reviewed and revised by the entire group. The recommendation level was primarily determined based on the evidence level, potential harms and benefits, and feasibility in clinical practice. Subsequently, recommendation levels were refined through anonymous online voting and discussions with the Development Committee. The evidence level for each statement was assessed from high (I) to low (V) based on the criteria set by the Oxford Centre for Evidence-Based Medicine by the designated members of the Development Committee (Supplementary Table 9) [15]. "Not applicable" (N/A) was assigned to statements for which an evidence level was not applicable.

External Advisory and Approval Committees

Advisory Committee members from the Korean Association of Hepato-Biliary-Pancreatic Surgery and the Korean Pancreatobiliary Association were requested. Additionally, we appointed experienced KSAR members in gallbladder (GB) disease and guideline development as Advisory Committee members from outside the Development Committee. Concurrently, we established an Approval Committee comprising KSAR members who were not involved in either the Development or Advisory Committees. We gathered insights from the Advisory Committee regarding the KQs and drafted statements through an online survey. Feedback was incorporated into the statements to the extent possible. Any aspects that could not be integrated are detailed in the Supplement addressing KQs and statements with a low level of agreement, along with their modifications.

Agreement Voting and Final Approval

An agreement vote on the recommendation statements was held during an in-person meeting of the KSAR on June 22, 2024. The consensus vote employed a 6-point modified Delphi method that included the following options: strongly agree, agree, somewhat agree, somewhat disagree, disagree, and strongly disagree. For this vote, the categories, "strongly agree" and "agree" were collectively considered to endorse the statement. Agreement was defined as ≥80% of the participants concurring with the statement. Statements that did not achieve an agreement level of ≥80% were revised by members of the Clinical Practice Guideline Committee. Details of the decision-making process regarding the revision of statements with low levels of agreement are provided in the Supplement. Subsequently, the final version was reviewed and approved by the Advisory and Approval Committees.

Key Questions and Recommendation Statements

The KQs and corresponding recommendation statements are presented in Table 1, along with the levels of recommendation, evidence, and agreement from the voting process. Fifty-three to 64 KSAR regular members (median, 60) participated in voting for each recommendation statement, and the recommendation statements for 31 of 54 recommendation statements reached ≥80% agreement after voting. Of those failing to reach 80% agreement, the recommendation statements under KQ 4, KQ 7, KQ 8, KQ 9, KQ 10, KQ 16, KQ 19, and KQ 20 remained unmodified after further discussion. The initial recommendation statements for KQ 2, KQ 21, and KQ 23 with agreement levels below 70%, which were later modified, are provided in Supplementary Table 10.

Elaborations

KQ 1. What is the Most Appropriate Method for Measuring the Size of a GBP?

S1-1: The longest diameter should be measured from outer margin to outer margin of the GBP
S1-2: Multiple US scan views are necessary to determine the longest diameter of the GBP
S1-3: For pedunculated GBPs, include the stalk in size measurement, but do not include any associated GBWT
(Recommendation level: Strong; Evidence level: N/A)

The size of the GBP is crucial for determining patient management. Accurate and precise measurements of GBP size are essential. To achieve this, patients should fast for more than 6 hours before the measurement is taken. Identifying the long axis of the GBP may require adjusting the orientation of the US probe by rotating it as

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Korean Journal of Radiology
KJR

Table 1. KQs and recommendation statements

KQs and final recommendation statements	Recommendation level; evidence level	Agreement level for the initial statement
KQ 1. What is the most appropriate method for measuring the size of a GBP? S1-1: The longest diameter should be measured from outer margin to outer margin of the GBP S1-2: Multiple US scan views are necessary to determine the longest diameter of the GBP S1-3: For pedunculated GBPs, include the stalk in size measurement, but do not include any associated GBWT	Strong; N/A	96.8%
KQ 2. What are the criteria for determining the echogenicity of GBP?* S2-1: We recommend primarily using the GB wall as a reference standard to describe GBP echogenicity S2-2: If a comparison with the GB wall is not feasible, the liver parenchymal echo can be used as an alternative standard to assess GBP echogenicity	Strong; N/A	65.6%
KQ 3. Which imaging features suggest non-neoplastic GBPs? S3-1: GBPs <6 mm without concerning imaging features are likely non-neoplastic S3-2: GBPs <10 mm without concerning imaging features are likely benign S3-3: Radiologic differentials should not be determined based on any single imaging feature alone, except for the size criteria Concerning imaging features: adjacent GBWT, sessility, or significant growth	Strong; II	87.2%
KQ 4. What is the cutoff for identifying significant growth in GBPs?† S4-1: We consider significant growth to be a change in size that results in a GBP moving from one size category to another (i.e., from <10 mm to ≥10 mm, or from 10–14 mm to ≥15 mm) S4-2: We consider significant growth to have occurred if there is an unequivocal change in size since the last follow-up regardless of changes in the size category S4-3: Changes that do not meet the above criteria are described in a radiology report, but they are not regarded as significant growth	Weak; III	63.3%
KQ 5. Which imaging features suggest neoplastic GBPs? S5-1: A size ≥10 mm is related to the risk of neoplastic and malignant GBPs S5-2: Radiologic differentials should not be determined based on any single imaging feature alone, except for the size criteria	Strong; II	90.5%
KQ 6. Should incidentally detected GBPs on US prompt CT or MRI for further assessment? S6-1: Routine CT or MRI is not recommended for incidentally detected GBPs on US S6-2: CT or MRI may be considered for patients with suspected malignant GBPs, those with a limited sonic window, or those scheduled for cholecystectomy	Strong; IV	85.9%
KQ 7. Is US recommended for incidentally detected GBPs on CT or MRI?† S7-1: GBPs <6 mm detected on CT or MRI do not require further examination S7-2: For GBPs ≥10 mm, if immediate cholecystectomy is not considered, additional US is an option S7-3: For GBPs measuring 6–9 mm, follow-up US should be conducted in 6 months to inform the management plan S7-4: Routine US is not recommended for further characterization of GBPs highly suspected of malignancy on CT or MRI	Strong; III	78.0%
KQ 8. Is US with a high-frequency transducer recommended for incidentally found GBPs on US?† S8: US with a high-frequency transducer can be considered for further characterization of GBPs ≥6 mm detected on US	Weak; III	61.0%
KQ 9. Is CEUS recommended for incidentally found GBPs on US?† S9-1: Routine CEUS is not recommended for incidentally detected GBPs S9-2: CEUS may be considered if cholecystectomy is deferred in patients with GBPs ≥10 mm, for GBPs 6–9 mm suspected to be malignant, or when CT or MRI is contraindicated	Strong; III	77.0%
KQ 10. Does Doppler US provide added value in characterizing GBPs?† S10: The added value of Doppler US is limited for differentiating GBPs. However, there is no need to limit the use of Doppler examinations	Strong; III	64.5%

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Table 1. KQs and recommendation statements (continued)

KQs and final recommendation statements	Recommendation level; evidence level	Agreement level for the initial statement
KQ 11. Is the risk of GBC higher in patients with GBPs than in those without? S11-1: Evidence supports an increased risk of GBC in patients with GBPs ≥10 mm compared to those without GBPs S11-2: However, for GBPs in general, supporting evidence is lacking for an increased risk of GBC in patients with GBPs compared to those without GBPs	Strong; II	91.1%
KQ 12. What are the key considerations when choosing surgery over US follow-up for managing GBPs? S12-1: We recommend cholecystectomy rather than US follow-up in surgically fit patients with GBPs ≥15 mm or GBPs measuring 10–14 mm with concerning imaging features S12-2: We recommend either cholecystectomy or US follow-up in surgically fit patients with GBPs measuring 10–14 mm without concerning imaging features or GBPs measuring 6–9 mm with concerning imaging features in patients ≥50 years Concerning imaging features: adjacent GBWT, sessility, or significant growth	Strong; III	95.1%
KQ 13. What are the non-imaging risk factors for GBC in patients with GBPs? S13-1: Old age, Asian ethnicity, and presence of PSC are known risk factors of GBC S13-2: We do not recommend adjusting the risk of malignancy of GBPs in radiology reports based on these demographic risk factors, except for tumor marker elevation	Strong; III	88.5%
KQ 14. Does the presence of gallstones increase the risk of malignancy in GBPs? S14-1: The presence of coexisting gallstones alone should not be considered indicative of a malignant GBP S14-2: A careful US inspection of the GB should be performed to avoid blind spots and to accurately assess the malignant risk of GBP	Strong; III	88.4%
KQ 15. How should GBPs be described in radiology reports? S15-1: Describe the presence of GBPs in the radiology report, regardless of size S15-2: GBPs <6 mm without concerning imaging features should be reported as "likely benign" S15-3: GBP size should be reported either as the actual size or in categorical terms indicating risks of malignancy (<6 mm; 6–9 mm; 10–14 mm; ≥15 mm) S15-4: When present, features suggesting malignancy should be reported Concerning imaging features: adjacent GBWT, sessile, significant growth	Strong; N/A	86.2%
KQ 16. Is follow-up required for GBPs <6 mm?† S16-1: Follow-up is not recommended for GBPs <6 mm without concerning imaging features S16-2: For GBPs <6 mm with concerning imaging features, follow-up is recommended Concerning imaging features: adjacent GBWT, sessility, or significant growth	Strong; I	63.5%
KQ 17. Is follow-up necessary for GBPs measuring 6–9 mm, and what is the appropriate follow-up interval? S17-1: For GBPs measuring 6–9 mm with concerning imaging features in patients <50 years or in patients ≥50 years without concerning imaging features, we recommend biannual follow-up for the first year and annual follow-ups for the next 4 years S17-2: For GBPs measuring 6–9 mm without concerning imaging features in patients <50 years, we recommend annual follow-ups for 5 years S17-3: If a GBP measuring 6–9 mm remains stable for 5 years, discontinuation of follow-up can be considered S17-4: If significant growth is observed during follow-up, the management plan should be re-evaluated based on imaging features and other risk factors Concerning imaging features: adjacent GBWT, sessile, significant growth	Strong; III	94.7%
KQ 18. What is the definition of GBWT? S18: We define GBWT using two categories: equivocal GBWT (wall thickness 3–4 mm) and definite GBWT (wall thickness ≥5 mm or localized distinctive wall thickening >3 mm)	Strong; N/A	87.7%

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Korean Journal of Radiology
KJR

Table 1. KQs and recommendation statements (continued)

KQs and final recommendation statements	Recommendation level; evidence level	Agreement level for the initial statement
KQ 19. Is US with a high-frequency transducer recommended for GBWT detected on the US?† S19: US with a high-frequency transducer can be considered for further characterization in US-detected GBWT	Strong; III	79.2%
KQ 20. Is US recommended for incidentally detected GBWT on CT or MRI, or vice versa?† S20-1: US can be considered if CT or MRI findings are inconclusive S20-2: CT or MRI can be considered in cases of inconclusive US features, a limited sonic window or suspected malignancy	Weak; IV	73.2%
KQ 21. Is CEUS recommended for characterizing GBWT detected on US?* S21-1: CEUS can be considered if US findings are not conclusive or limitedly evaluable S21-2: CEUS is not recommended for definite malignancy or definite benign GBWT on US S21-3: CEUS can be considered as a priority only if CT and MRI are not available or contraindicated	Weak; III	40.0%
KQ 22. What is the most appropriate follow-up interval and modality for indeterminate GBWT? S22-1: Follow-up in 3–6 months using US is recommended for GBWT with an indeterminate risk of malignancy S22-2: CT, MRI, and EUS can be considered as alternatives depending on the individual risk of malignancy, or in patients with limited sonic window	Weak; IV	83.7%
KQ 23. Is follow-up recommended for ADM?* S23-1: Follow-up is not required for ADM with typical imaging features S23-2: If GBC and ADM cannot be clearly differentiated, follow-up with US, CT, or MRI is recommended	Strong; IV	66.1%
KQ 24. What examinations should be considered for patients with a limited sonic window? S24-1: CT, MRI, or EUS should be considered in patients with an unspecified GBL on US for its characterization, and the selection of modality should be based on the individual risk of malignancy and the potential visibility of the GBL S24-2: CT and MRI can be primarily considered for surveillance of GBLs	Weak; IV	89.5%

*†The recommendation statements were modified (*) and kept unchanged (†) after further discussion, given the low level of agreement for the initial statements. The initial statements for KQ 2, KQ 21, and KQ 23 are provided in Supplementary Table 10.
KQ = key question, GBP = gallbladder polyp, US = ultrasound, GB = gallbladder, GBWT = gallbladder wall thickening, CEUS = contrast-enhanced ultrasound, GBC = gallbladder cancer, PSC = primary sclerosing cholangitis, EUS = endoscopic ultrasound, ADM = adenomyomatosis, GBL = gallbladder lesion

necessary. This does not imply that the GBP must always be measured bidimensionally. If the operator is unsure of the largest diameter owing to the shape of the GBP, it is advisable to measure the size while altering the probe angle and record the largest apparent size of the GBP. To differentiate between pedunculated and sessile polyps, we used the definition endorsed by the Society of Radiologists in Ultrasound (SRU) [12]. Unlike colorectal polyps, when measuring the size of a GBP, we recommend including stalks when they are part of a plane with the longest diameter. Although including stalks in GBP size measurements might raise concerns about overestimation, it is important to note that GBPs with distinct long stalks are uncommon, and thin stalks are often difficult to visualize. Furthermore, pedunculated GBPs typically exhibit a "ball-on-the-wall" appearance [12], which complicates the exclusion of stalks from the measurements. To ensure consistency, we included stalks in the measurement of GBP size (Fig. 1). If there are concerns about potential overestimation due to distinct long stalks, radiologists can explicitly state the inclusion of the stalk in their reports, for example, "10 mm including stalk." Additionally, we recommend using millimeter units and rounded decimal places to further reduce interobserver variability.

When GBPs are accompanied by an adjacent GBWT, the GBWT should be considered and evaluated as a separate concerning imaging feature, as discussed in KQ 5. In such cases, the GBWT should be evaluated separately and excluded from the size measurement of the GBP.

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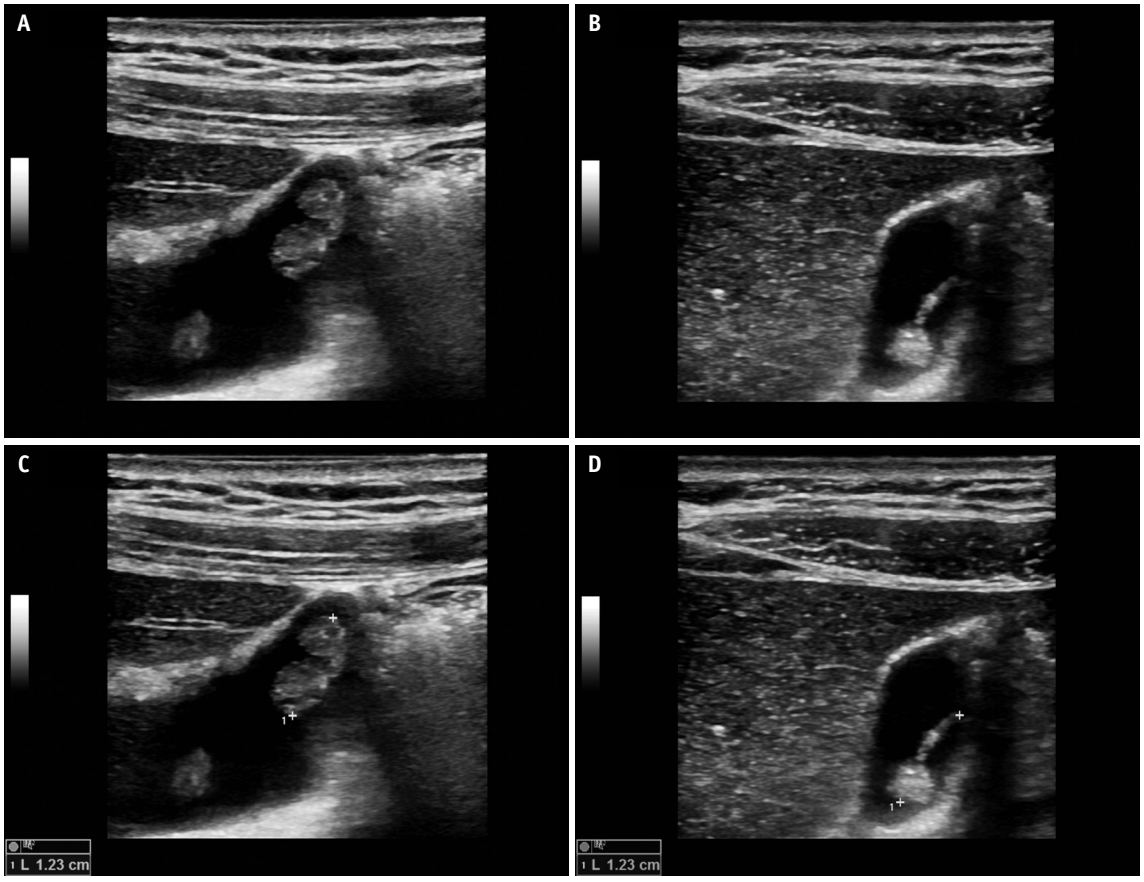

Fig. 1. Measurement of the size of GBPs. **A, B:** The longest diameter should be confirmed across various ultrasound views. **C, D:** The size is measured from the outer margin to the outer margin of the pedunculated GBP in a 30-year-old woman. GBP = gallbladder polyp

KQ 2. What are the Criteria for Determining the Echogenicity of GBP?

S2-1: We recommend primarily using the GB wall as a reference standard to describe GBP echogenicity
S2-2: If a comparison with the GB wall is not feasible, the liver parenchymal echo can be used as an alternative standard to assess GBP echogenicity
(Recommendation level: Strong; Evidence level: N/A)

Although there is no consensus regarding whether the echogenicity of GBPs is related to the risk of neoplastic or malignant polyps, it remains a frequently reported US feature. The echogenicity of a GBP is typically described as "hyper" or "hypo," yet the reference standard is not clearly defined in the literature. The GB wall is sometimes used as a reference standard, while other sources report using liver parenchymal echo [16-19]. The liver parenchyma is easily assessable; however, the presence of hepatic steatosis or other diffuse liver diseases may affect the evaluation. Therefore, we recommend primarily using the GB wall as the reference standard for assessing GBP echogenicity and suggest using the liver parenchyma as an alternative. When using the GB wall as a criterion for evaluating GBP echogenicity, it is advisable to compare the echogenicity of the GBP with that of the adjacent GB wall to minimize the effect of posterior enhancement by bile in the GB (Fig. 2). The use of liver parenchymal echogenicity as a reference should be reserved for situations in which comparison with GB wall echogenicity is not feasible or reliable, such as in cases with multiple or large GB stones. We recognize that the clinical significance of echogenicity of GBP remains a matter of debate, partly because of the inherent subjectivity of its description. This recommendation is intended to improve consistency in radiology reports by providing a standardized approach for describing GBP echogenicity.

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Korean Journal of Radiology
KJR

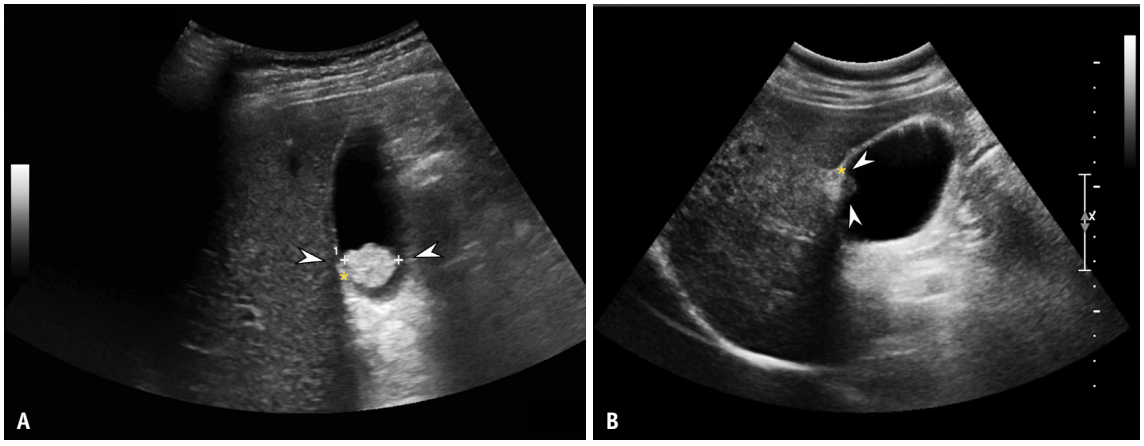

Fig. 2. Description of echogenicity of GBPs. **A:** On ultrasound, a 13 mm GBP (arrowheads) exhibits hyperechogenicity compared to the adjacent GB wall (asterisk) in a 55-year-old man. **B:** An 8 mm GBP (arrowheads) displays hypoechogenicity relative to the adjacent GB wall (asterisk) in a 58-year-old man. GBP = gallbladder polyp, GB = gallbladder

KQ 3. Which Imaging Features Suggest Non-Neoplastic GBPs?

S3-1: GBPs <6 mm without concerning imaging features are likely non-neoplastic
S3-2: GBPs <10 mm without concerning imaging features are likely benign
S3-3: Radiologic differentials should not be determined based on any single imaging feature alone, except for the size criteria
Concerning imaging features: adjacent GBWT, sessility, or significant growth
(Recommendation level: Strong; Evidence level: II)

The size of the GBP is a key determinant of its characteristics. Studies have reported a low risk of neoplastic GBPs or malignancy in GBPs <6 mm [7,8,20-22]. The incidence of GBC in GBPs <6 mm was 1.3/100000 person-years (py), and no GBC was found in GBPs with an average size of 4–5 mm on follow-up. Therefore, we believe that GBPs <6 mm are highly likely to be non-neoplastic unless concerning imaging features are present, which are discussed in KQs 5, 12, and 16. Occasionally, 6–9 mm GBPs are neoplastic, although malignancy is rare [8,23,24]. Generally, neoplastic or malignant polyps are more common in GBPs ≥10 mm [25,26]. Even if the size of a GBP is <10 mm, caution should be exercised in its characterization if concerning imaging features (adjacent GBWT, sessility, and significant growth) are present (Fig. 3). In addition, these criteria are not applicable to high risk groups, such as patients with PSC or elevated tumor markers.

In addition to GBP size, several imaging characteristics have been associated with benignity, including echogenicity (hyperechoic), presence of hyperechoic foci, multiplicity (multiple), shape (pedunculated), and presence of comet-tail artifacts [6,19,27-59]. However, confounding factors, such as size, have often been overlooked, and these features have often been found to be non-significant in multivariable analyses. Therefore, a differential diagnosis should be made cautiously, considering multiple features together, rather than relying on a single imaging feature.

KQ 4. What is the Cutoff for Identifying Significant Growth in GBPs?

S4-1: We consider significant growth to be a change in size that results in a GBP moving from one size category to another (i.e., from <10 mm to ≥10 mm, or from 10–14 mm to ≥15 mm)
S4-2: We consider significant growth to have occurred if there is an unequivocal change in size since the last follow-up regardless of changes in the size category
S4-3: Changes that do not meet the above criteria are described in a radiology report, but they are not regarded as significant growth
(Recommendation level: Weak; Evidence level: III)

Several guidelines, including the European multi-society guidelines, the World Federation of Ultrasound in Medicine

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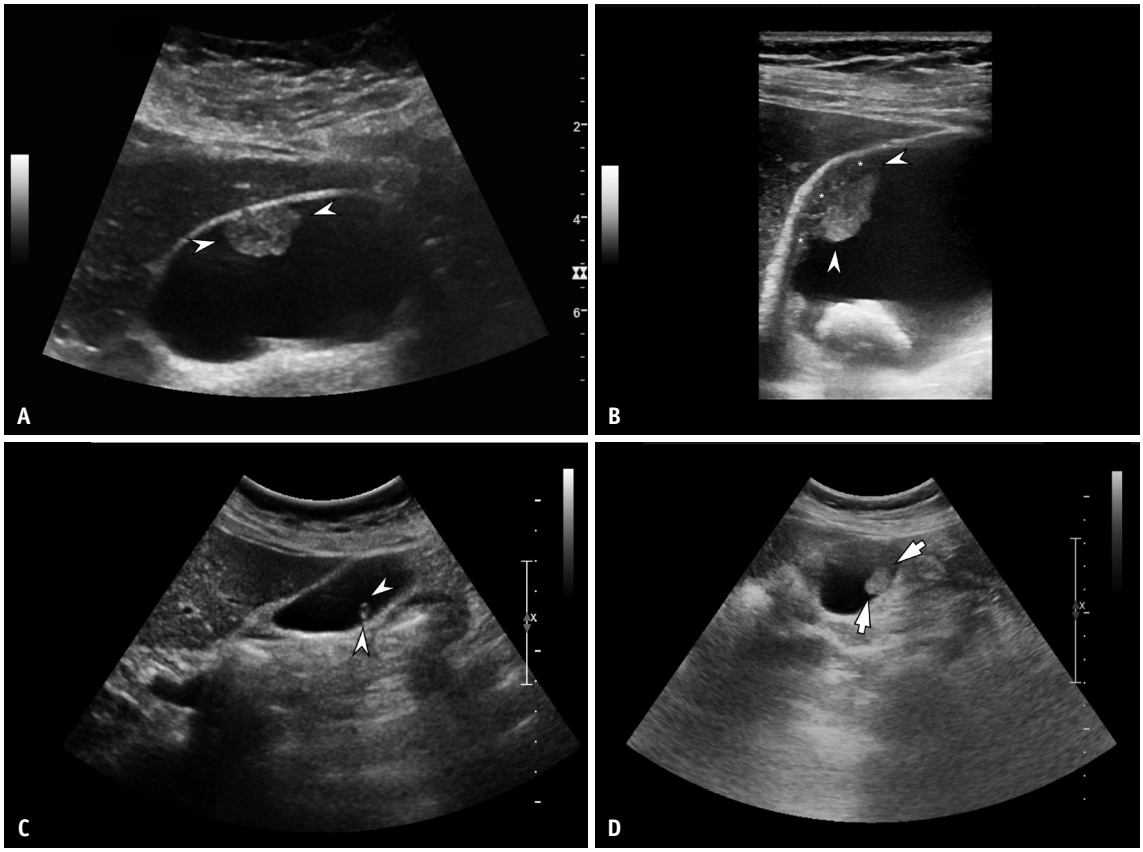

Fig. 3. Concerning image features. **A:** A 13 mm GBP (arrowheads) exhibits a sessile appearance, broadly attaching to the gallbladder wall without a visible stalk. **B:** A 14 mm GBP (arrowheads) is associated with adjacent gallbladder wall thickening (asterisks), which was later confirmed surgically to be gallbladder cancer. **C, D:** A 6 mm pedunculated GBP (**C**, arrowheads) demonstrates significant growth to 13 mm at the 1-year follow-up (**D**, arrows). GBP was diagnosed as tubular adenoma with low-grade dysplasia. GBP = gallbladder polyp

and Biology (WFUMB) position paper, and the Canadian Association of Radiologists Incidental Findings Working Group recommendation, identify an increase in size as a concerning feature of GBPs [13,14,60]. However, there is no universally agreed upon threshold for defining significant growth. The European multi-society guideline suggests that the current size of GBPs with an increase of ≥2 mm within a 2-year follow-up, considered alongside risk factors, should be noted. In contrast, the WFUMB position paper recommends further evaluation of GBPs measuring 7–9 mm that exhibit a growth of ≥2 mm, although it does not specify the time interval [13,14].

US measurements of GBP size can have significant interobserver variability. One study reported that the 95% limits of agreement for inter- and intra-observer variability ranged from 21% to 34% for GBPs [17]. Although that study suggested that a 2 mm difference falls outside the 95% confidence interval (CI) and therefore supports the current growth criteria, this conclusion is debatable, as other factors, such as variations in GB distension between examinations, can also affect long-term reproducibility.

Furthermore, the clinical significance of GBP growth or growth rate remains unclear; some studies have reported that it is significant, whereas others have reported that it is insignificant [6,46,49,52,61,62]. This inconsistency may stem from unclear criteria for defining interval growth and potential measurement errors. For instance, certain studies have calculated growth rates by comparing initial and final sizes without conducting regular monitoring, which may not accurately represent true growth rates. Additionally, some studies have used small increments in growth rates as thresholds, which may not ensure precise measurements [46,52]. A recent cohort study reported that a GBP size increase (≥2 mm) was observed in up to 66.2% (<6 mm) and 52.9% (6–10 mm) of GBP cases, and this size increase (≥2 mm) was not specific to malignant GBPs [7]. A recent study reported that although approximately 10% of GBPs increased in size, no GBC were observed [63]. This suggests that a 2 mm increase can be considered natural and that growth itself is part of the natural course of GBPs, not

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Korean Journal of Radiology
KJR

necessarily indicating malignancy. As a result, the SRU defined "rapid growth" as a ≥4 mm increase per year [12].

Based on current evidence, we did not consider a specific growth rate of 2 mm over 2 years or any interval as a reliable indicator of malignancy. Instead, we believe that the final size resulting from growth is more critical. Therefore, we only considered a change in size to indicate significant growth when our size category (<6 mm, 6–9 mm, 10–14 mm, ≥15 mm) shifted toward a higher risk of malignancy or when there was a clear increase in size on visual assessment since the last follow-up, regardless of whether the category changed. Specifically, transitions from <10 mm to ≥10 mm and from 10 to 14 mm to ≥15 mm were considered significant growth. The rationale behind these size category criteria is discussed in the KQ 12. We did not view a category change from <6 mm to 6–9 mm as significant growth owing to potential measurement errors in small GBPs and the low probability of malignancy in this category. In addition to changes in size category, an "unequivocal size increase," which refers to an obvious difference in the size of a GBP, is also considered a significant growth, even if there is no category change. This definition applies to both GBPs <10 mm and GBP ≥10 mm. For example, if a 4 mm GBP increases in size to 8 mm, this does not involve a change in size category suggesting significant growth but can be considered an unequivocal change in size, and therefore, can be classified as significant growth. Changes that do not meet these criteria are noted in a radiology report but are not considered significant growth. Our definition of significant growth includes the concept of growth rate by comparing sizes at different time points. However, we intentionally avoided specifying fixed intervals, such as one or two years, to ensure broader applicability. Instead, we use the term "last follow-up" because regular surveillance of GBPs is often inconsistent in clinical practice. However, a limitation of this approach is that without regular surveillance, it is difficult to determine whether a polyp has undergone rapid growth (growth spurts), and it may accommodate the consideration that gradual size increases over time as significant growth. It should be noted that the growth of GBP to 10 mm is not necessarily associated with malignancy [7]. Given these uncertainties regarding growth rate and malignant risk, and the potential clinical implications of GBPs reaching or exceeding 10 mm, we recommend defining significant growth based on final size rather than growth rate.

KQ 5. Which Imaging Features Suggest Neoplastic GBPs?

S5-1: A size ≥10 mm is related to the risk of neoplastic and malignant GBPs
S5-2: Radiologic differentials should not be determined based on any single imaging feature alone, except for the size criteria
(Recommendation level: Strong; Evidence level: II)

It is well known that the size of the GBP is related to the risk of GBC or neoplastic polyps. In particular, GBPs ≥10 mm have been reported to exhibit a higher likelihood of being neoplastic polyps [3,9,20,22,30,37,42-45,48,51,52,57,58,61,64-78].

Other malignant GBP imaging features include single, hypoechogenicity, heterogeneous echogenicity, sessile nature, and the presence of adjacent GBWT [6,18,25,27,33-35,39,42,46-52,55,56,58,62,79,80]. However, data that consider covariables are sparse. Furthermore, although these imaging features are associated with neoplastic or malignant GBPs, the predominance of non-neoplastic or benign GBPs in daily clinical practice may reduce their positive predictive value. Therefore, diagnoses should be based on a comprehensive interpretation of the observed imaging features rather than relying on a single feature.

Adjacent GBWT requires careful monitoring by operators, as it may be associated with GBC. Therefore, if GBWT is present and cannot be attributed to benign conditions such as edema, cholecystitis, or adenomyomatosis (ADM), special management considerations are required because of the risk of GBC regardless of the morphology of the GBP. When imaging features strongly suggest malignancy in conjunction with GBP, GBC should be the primary consideration. Features such as GBWT with discontinuity, invasion into adjacent liver parenchyma, concurrent liver mass, adjacent peritoneal mass, pathological lymphadenopathy, and biliary obstruction are commonly associated with GBC [12,81].

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KQ 6. Should Incidentally Detected GBPs on US Prompt CT or MRI for Further Assessment?

S6-1: Routine CT or MRI is not recommended for incidentally detected GBPs on US
S6-2: CT or MRI may be considered for patients with suspected malignant GBPs, those with a limited sonic window, or those scheduled for cholecystectomy
(Recommendation level: Strong; Evidence level: IV)

For GBPs incidentally detected on US, we do not recommend the routine use of CT or MRI for further evaluation. This recommendation stems from two main reasons: the potentially limited visibility of small GBPs on CT or MRI and the low probability of malignancy in incidentally detected GBPs. Studies on the visibility of GBPs on CT have yielded mixed results. For instance, a recent study found that only 63.3% (19/30) of GBPs (≥10 mm) identified on US were visible on CT [27], whereas another study reported that all GBPs (>10 mm) were identified on CT [80]. Although reports in the literature are inconsistent, it is generally observed that CT visibility improves with larger GBP. Consequently, there is no assurance that all small GBPs observed on US are detectable on CT or MRI. Furthermore, the low risk of malignancy in incidentally detected GBPs reinforces the recommendation against the routine use of CT or MRI.

Moreover, there is currently no clear evidence that CT or MRI outperforms US in the characterization of GBPs. One study reported that the visibility of GBPs on CT was associated with their likelihood of being neoplastic, whereas other studies have shown the visibility of both neoplastic and non-neoplastic GBPs. Additionally, one study linked arterial phase enhancement to neoplastic polyps, whereas another found no substantial differences [27,62,80,82]. Therefore, the criteria for differential diagnosis using CT or MRI are not as robust as those used for US. Furthermore, few studies have directly compared these two modalities with US, and most have included cases of GBC, potentially leading to an overestimation of the performance of CT or MRI. However, CT does not perform poorly in studies that include gallbladder lesions (GBL) [80,83], with reported sensitivities of 72.4%–83.9% and specificities of 77.6%–91.3% for differentiating between malignant and benign GBPs, or neoplastic and non-neoplastic GBPs. Therefore, we believe that CT or MRI should be considered when malignancy is suspected, such as in cases of GBPs ≥10 mm, GBPs with concerning imaging features, or GBPs accompanied by features highly suggestive of malignancy, such as a concurrent liver mass.

Furthermore, CT or MRI may be considered for patients with a limited sonic window, requiring further evaluation. In patients scheduled for cholecystectomy, CT or MRI can be used to assess anatomical variations during the preoperative workup.

KQ 7. Is US Recommended for Incidentally Detected GBPs on CT or MRI?

S7-1: GBPs <6 mm detected on CT or MRI do not require further examination
S7-2: For GBPs ≥10 mm, if immediate cholecystectomy is not considered, additional US is an option
S7-3: For GBPs measuring 6–9 mm, follow-up US should be conducted in 6 months to inform the management plan
S7-4: Routine US is not recommended for further characterization of GBPs highly suspected of malignancy on CT or MRI
(Recommendation level: Strong; Evidence level: III)

The performance of CT and MRI in characterizing GBPs has rarely been reported in the literature, and available studies are often limited because of selection bias and small study populations. Furthermore, the clinical significance of GBP visibility on CT scans remains unclear, as not all GBPs visible on CT are neoplastic or malignant [27,62,80,82,84].

Therefore, we recommend a size-based approach for GBPs incidentally detected on CT or MRI scans. This recommendation stems from the current limitations in the visibility of GBPs on CT scans and the lack of sufficient data on CT or MRI for GBP characterization, as discussed earlier in the KQ 6. As previously described in KQ 3 and KQ 5, although the US imaging features of benign and malignant GBPs are relatively well known, research on the CT and MRI features of GBPs, whether benign or malignant, remains limited. Therefore, performing additional US examinations to assess known benign and malignant features may be helpful.

However, for GBPs <6 mm identified on CT or MRI, additional examinations are generally not necessary because these polyps are predominantly non-neoplastic. In cases

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Korean Journal of Radiology
KJR

where GBPs are ≥10 mm and immediate cholecystectomy is not planned, additional US examination can be promptly conducted to assist in further characterization. GBPs measuring 6–9 mm on CT or MRI should be managed in a manner similar to that detected on US, including follow-up US after 6 months. The justification for this 6-month follow-up interval is detailed in KQ 17. When malignancy is highly suspected based on CT or MRI findings, US is unlikely to provide additional diagnostic value for characterizing GBPs. Therefore, US is not recommended in these scenarios. However, in cases requiring T-staging where malignancy is suspected, the use of a high-frequency transducer in US may be considered [85,86].

KQ 8. Is US With a High-Frequency Transducer Recommended for Incidentally Found GBPs on US?

S8: US with a high-frequency transducer can be considered for further characterization of GBPs ≥6 mm detected on US
(Recommendation level: Weak; Evidence level: III)

US with a high-frequency transducer is a technique in which both low- and high-frequency transducers are used. The low-frequency transducer operates at 4–4.5 MHz with a convex probe, whereas the high-frequency transducer ranges from 6 to 7 MHz and may utilize either linear or convex probes. Techniques such as spatial compound imaging, speckle reduction, and harmonic imaging have been employed to enhance the visualization of small structures within the GB [86]. The utility of this technique for GBL evaluation has been reported [83,85-88], and US applying a high-frequency transducer exhibited a sensitivity of 70.0%–89.6% and specificity of 44.4%–86.9% for differentiating benign and malignant GBLs [83,86,89]. However, there is a lack of direct comparative data on the performance of US with a high-frequency transducer versus conventional US in characterizing GBPs. The theoretical advantages of using a high-frequency transducer over conventional US include better visualization of GBP echogenicity and adjacent walls, providing high-resolution images in real-time (Fig. 4). Indeed, studies have shown improved diagnostic performance for GBC, ADM, and staging of GBC when using a high-frequency transducer compared with conventional US [83,85,87,88]. Additionally, the use of a high-frequency transducer in US is associated with minimal additional risk to patients. Therefore, it can be considered for patients with GBPs incidentally detected on US. We do not recommend using a high-frequency transducer for GBPs <6 mm because of the high likelihood of benignity in these cases, which limits the utility of this US technique.

It is important to clarify that the use of high-frequency transducers in the US does not require specialized probes or equipment from specific manufacturers. We encourage operators to enhance the spatial resolution by carefully adjusting the scan parameters and using the technologies available in the existing systems.

However, it is crucial to recognize that this technique still has inherent limitations of US. Challenges such as limited sonic windows and poor penetration owing to other GB intraluminal lesions persist when using high-frequency

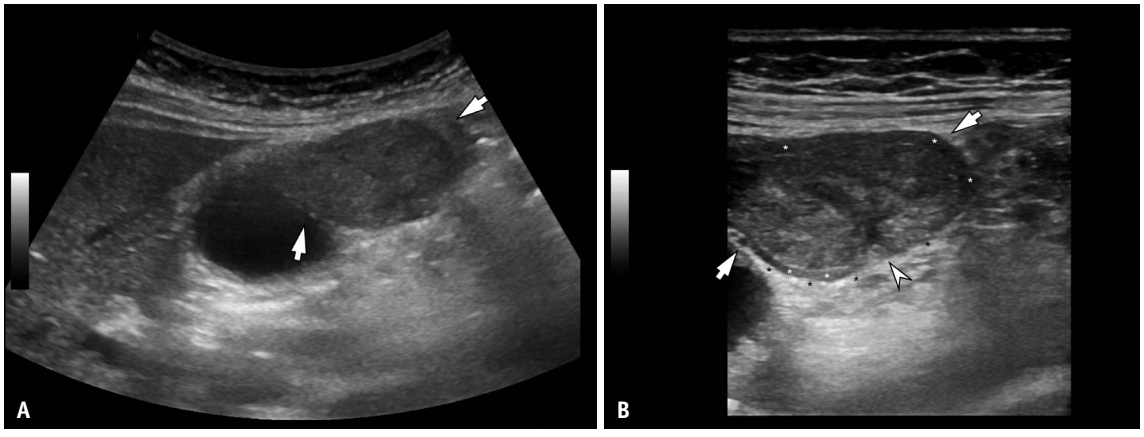

Fig. 4. Comparison between conventional US and US with a high-frequency transducer. **A:** A 25 mm GBP (arrows) is observed on conventional US in a 67-year-old woman. **B:** Using a linear high-frequency transducer on the same scanner, the GBP (arrows), muscle layer (white asterisks), and perimuscular connective tissue layer (black asterisks) are clearly visualized. Focal disruption of the muscle layer (arrowhead) is suspected, which may suggest malignancy. US = ultrasound, GBP = gallbladder polyp

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transducers. Under conditions in which these limitations are significant, the application of high-frequency transducers may not yield substantial additional information on GBPs.

KQ 9. Is CEUS Recommended for Incidentally Found GBPs on US?

S9-1: Routine CEUS is not recommended for incidentally detected GBPs
S9-2: CEUS may be considered if cholecystectomy is deferred in patients with GBPs ≥10 mm, for GBPs 6–9 mm suspected to be malignant, or when CT or MRI is contraindicated
(Recommendation level: Strong; Evidence level: III)

Contrast-enhanced ultrasound (CEUS) has been reported to show higher diagnostic performance than conventional US in differentiating between benign and malignant GBLs. A systematic review reported that the sensitivity and specificity of CEUS and contrast-enhanced endoscopic ultrasound (EUS) for differentiating GB adenomas from other lesions were 84.6% (95% CI: 81.8%–87.1%) and 87.0% (95% CI: 84.4%–89.4%), respectively, despite the heterogeneity of the included disease entities [90]. However, few studies have directly compared US and CEUS for GBP characterization [31,54,73,91]. Most studies have either reported the performance of CEUS alone or compared it with that of CT; some studies have included GBWT or GB stones along with GBPs. Studies comparing US and CEUS for the differentiation of benign and malignant GBLs showed sensitivity of 22.2%–82.4% and specificity of 89.8%–98.1% for US, and sensitivity of 66.7%-94.1% and specificity of 92.5%–99.1% for CEUS [73,91]. Therefore, CEUS increased both sensitivity and specificity compared to US (Fig. 5). However, the technical complexity and inconsistent criteria for determining malignancy make it difficult to recommend CEUS. Most studies have compared benign and malignant features on CEUS, such as arterial phase enhancement, rapid washout, time-to-intensity curves, and vascular patterns (branching vs. linear or dotted), leading to uncertainty regarding the criteria that should be adopted for GBP characterization.

Most studies have focused on distinguishing benign from malignant GBLs, and there is limited evidence regarding the performance of CEUS in differentiating non-neoplastic from neoplastic GBPs. There is no evidence that CEUS features outperform B-mode imaging size criteria in small GBPs. In fact, one study showed no significant difference in accuracy between CEUS and US for GBPs <10 mm [73]. Therefore, we do not recommend CEUS for GBPs <6 mm, which are rarely neoplastic or malignant. For GBPs between 6 and 9 mm, considering the high likelihood of benignity, technical complexity of CEUS, and heterogeneous malignancy diagnostic criteria, routine CEUS is not considered appropriate.

Based on the above considerations, we believe that CEUS can be considered for GBPs ≥10 mm when immediate cholecystectomy is not performed or GBPs between 6 and 9 mm with imaging features that suggest the possibility

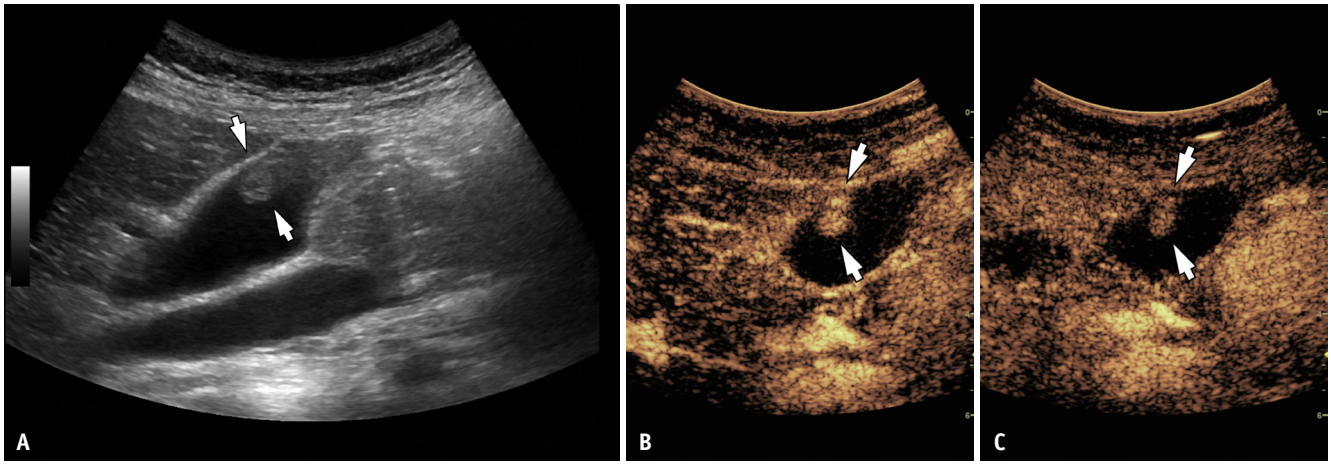

Fig. 5. CEUS findings in a surgically confirmed cholesterol GBP in a 63-year-old woman. **A:** A 10 mm GBP is in the fundus (arrows). **B, C:** CEUS shows arterial hyperenhancement (**B**, arrows) and the absence of early washout in the venous phase (**C**, arrows), indicating a relatively low likelihood of neoplastic or malignant GBP. Courtesy of Professor Se Hyung Kim, MD, and Professor Jae Seok Bae, MD, at Seoul National University Hospital. CEUS = contrast-enhanced ultrasound, GBP = gallbladder polyp

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Korean Journal of Radiology
KJR

of malignancy. CEUS can also be considered in cases where CT or MRI is indicated but cannot be performed owing to underlying medical conditions.

KQ 10. Does Doppler US Provide Added Value in Characterizing GBPs?

S10: The added value of Doppler US is limited for differentiating GBPs. However, there is no need to limit the use of Doppler examinations
(Recommendation level: Strong; Evidence level: III)

While polyp vascularity on Doppler US is more commonly associated with neoplastic or malignant GBPs, it can also appear in inflammatory polyps [20,33,73,92]. Preliminary data on newer microvascular flow imaging techniques appear promising, but require further validation [29]. Different guidelines offer different recommendations for the use of Doppler US to characterize GBPs. A recent WFUMB position paper suggested that color Doppler imaging may help characterize GBPs as part of a multiparametric scoring system in combination with B-mode features, although the quality of evidence was rated as low [14]. The SRU guidelines state that polyp vascularity should not influence risk stratification, noting that larger benign polyps may demonstrate internal vascularity using sensitive Doppler techniques [12]. However, because most US systems are equipped with Doppler capabilities, we believe that it is not necessary to restrict their use (Fig. 6). Doppler US may reveal twinkling artifacts that are highly suggestive of benign lesions (Fig. 7). However, it is crucial to interpret any observed polyp vascularity with caution, as it is not a definitive indicator of neoplastic or malignant GBPs. Such findings should be considered alongside B-mode findings, particularly when considering the size of the GBP. In summary, Doppler US can be utilized in the evaluation of GBPs, with the understanding that its findings must be interpreted in conjunction with B-mode US features.

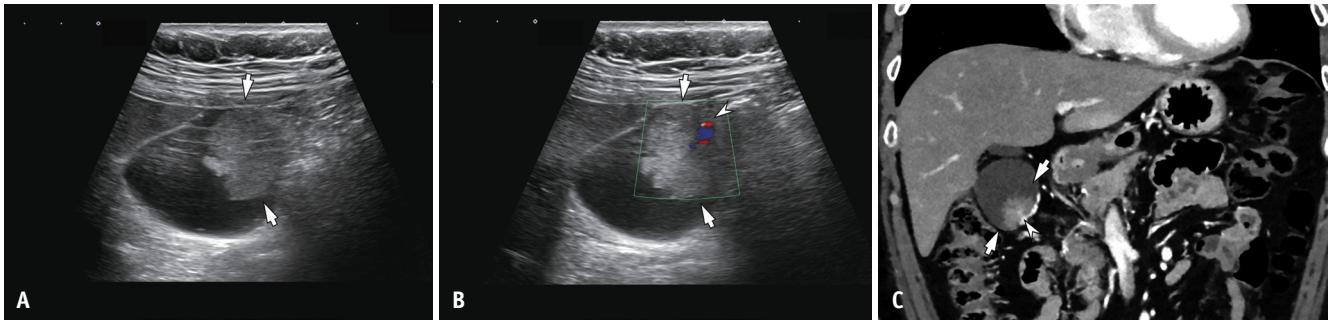

Fig. 6. Doppler US to identify the vascular stalk. **A, B:** A 25 mm GBP (**A**, **B**, arrows) exhibits a strong vascular stalk on Doppler US (**B**, arrowhead). **C:** Contrast-enhanced CT image showing the polyp (arrows) with a vascular stalk (arrowhead). GBP was surgically confirmed to be a pyloric gland adenoma. US = ultrasound, GBP = gallbladder polyp

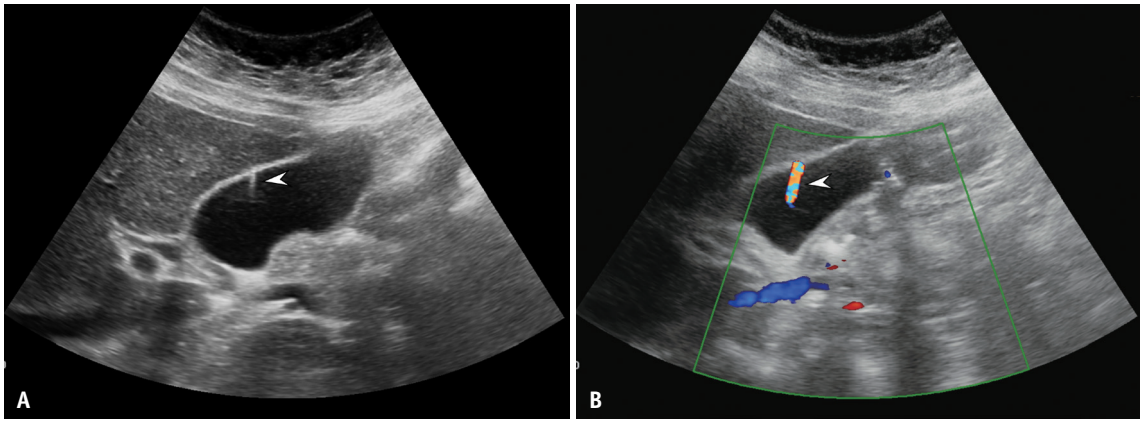

Fig. 7. Twinkling artifact on Doppler US. **A:** A 3 mm gallbladder polyp displays a comet-tail artifact on B-mode US (arrowhead). **B:** The twinkling artifact is depicted on Doppler US (arrowhead). Both results suggest the presence of cholesterol. US = ultrasound

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KQ 11. Is the Risk of GBC Higher in Patients With GBPs Than in Those Without?

S11-1: Evidence supports an increased risk of GBC in patients with GBPs ≥10 mm compared to those without GBPs
S11-2: However, for GBPs in general, supporting evidence is lacking for an increased risk of GBC in patients with GBPs compared to those without GBPs
(Recommendation level: Strong; Evidence level: II)

The adenoma-carcinoma sequence, which is observed in 5%–10% of GBC cases [93], is one of the models of GB carcinogenesis. Intracholecystic papillary neoplasms (ICPNs) and pyloric gland adenomas represent this sequence [93,94]. Based on this model, several studies have investigated the relationship between GBPs and GBC.

Previous studies have suggested that GBPs is a risk factor for GBC. A study in the United Kingdom reported a higher prevalence of GBC in individuals with GBPs than in those without GBPs. The prevalence of GBPs was 3.3% (2359/71431), and single GBPs (≥10 mm) were a significant risk factor for GBC compared to the absence of GBPs [2]. A study from South Korea also reported an association between GBPs and GBC, with a cumulative incidence of neoplastic GBPs of 1.7% at one year, 2.8% at five years, and 4% at eight years after GBP diagnosis. The cumulative detection rates of malignant GBPs were 0.2% at one year and 1% at five years in 1027 patients who underwent follow-up for over a year [66].

Recent studies have confirmed the relationship between GBPs ≥10 mm and GBC; however, they also indicated that the overall incidence of GBC in patients with GBPs is rare. Furthermore, most GBPs are stable or decrease in size over time [8,24,63,68,95-99]. A study from Japan reported that GBPs >10 mm were associated with the occurrence of GBC, whereas the overall prevalence of GBPs was not correlated with GBC [1]. In a 20-year cohort study involving 622227 patients of multiple ethnicities, the unadjusted overall crude proportion of GBC was similar between patients with and without GBPs (0.053% [19/35856] vs. 0.054% [316/586357], $P = 0.94$) [7]. This finding underscores the low prevalence of neoplastic GBPs and suggests that the adenoma-carcinoma sequence plays a minor role in GB carcinogenesis compared to the metaplasia-neoplasia-carcinoma sequence [93].

Based on these findings, we assert that not all patients with GBPs are at a high risk of developing GBC. Instead, risk levels should be stratified according to the size of the GBP. This finding suggests that risk stratification based on size is a crucial strategy for managing GBPs.

KQ 12. What are the Key Considerations When Choosing Surgery Over US Follow-Up for Managing GBPs?

S12-1: We recommend cholecystectomy rather than US follow-up in surgically fit patients with GBPs ≥15 mm or GBPs measuring 10–14 mm with concerning imaging features
S12-2: We recommend either cholecystectomy or US follow-up in surgically fit patients with GBPs measuring 10–14 mm without concerning imaging features or GBPs measuring 6–9 mm with concerning imaging features in patients ≥50 years
Concerning imaging features: adjacent GBWT, sessility, or significant growth
(Recommendation level: Strong; Evidence level: III)

In the guidelines, cholecystectomy is indicated based on the size of the GBP (≥10 mm), with optional cholecystectomy considered for smaller GBPs with concerning imaging features or non-imaging risk factors (Table 2) [5,12-14,60]. These recommendations are based on the relationship between GBPs ≥10 mm and GBC or neoplastic GBPs [26]. Studies from East Asia (South Korea, Japan, and China) also reported the risk of GBC or neoplastic GBPs in patients with GBPs ≥10 mm and older age (≥50 or ≥60 years) [9,40,42,75,76]. In addition to size and age, morphological features such as single and sessile GBPs have been associated with an increased risk [40,48,71,76,100].

However, the cutoff size criterion (≥10 mm) has been challenged by studies owing to its modest sensitivity. Some studies in Asia have reported the incidence of neoplastic GBPs or GBC in GBPs <10 mm [6,66]. Based on these findings, some authors have suggested lowering the cutoff value to increase the sensitivity of detecting neoplastic or malignant GBPs. They argued that performing cholecystectomy even for GBPs <10 mm is justified because the postoperative morbidity and mortality rates are very low in the era of minimally invasive surgery compared to the potential risk of GBC [3,6,56]. Conversely, researchers have questioned the appropriateness of the ≥10 mm cutoff for

https://doi.org/10.3348/kjr.2024.0914

Korean Journal of Radiology
KJR

Table 2. Surgical indications for GBP in current clinical guidelines

Guidelines	Surgical indications
KSAR (2025)	In surgically fit patients, ≥15 mm GBP or 10–14 mm GBP with concerning imaging features 10–14 mm GBP without concerning imaging features (optional) 6–9 mm GBP with concerning image features in patients ≥50 years (optional) Concerning imaging features: adjacent GBWT, sessility, or significant growth
SRU (2022)	Extremely low risk and low risk: ≥15 mm Extremely low risk and low risk: 10–14 mm (optional) Indeterminate risk: ≥7 mm Indeterminate risk: ≤6 mm (optional)
ESGAR/EAES/EFISDS/ESGE (2022)	In patients who are fit and agree to surgery, ≥10 mm GBP Symptomatic GBP GBP in 6–9 mm with one or more risk factors (>60 years, PSC, Asian, sessility, or focal GBWT >4 mm)
WFUMB (2022)	≥10 mm GBP 7–9 mm GBP with risk factors (Indian ethnicity, PSC, features with high risk of malignancy on US, EUS, CEUS)
CAR (2020)	≥10 mm GBP
KAHBPS (2010)	≥10 mm GBP GBP with size increase Symptomatic GBP GBP <10 mm with risk factors (coexisting gallstone, single, sessility, ≥50 years)

GBP = gallbladder polyp, KSAR = Korean Society of Abdominal Radiology, GBWT = gallbladder wall thickening, SRU = Society of Radiologists in Ultrasound, ESGAR = European Society of Gastrointestinal and Abdominal Radiology, EAES = European Association for Endoscopic Surgery and other Interventional Techniques, EFISDS = International Society of Digestive Surgery-European Federation, ESGE = European Society of Gastrointestinal Endoscopy, PSC = primary sclerosing cholangitis, WFUMB = World Federation for Ultrasound in Medicine and Biology, US = ultrasound, EUS = endoscopic ultrasound, CEUS = contrast-enhanced ultrasound, CAR = Canadian Association of Radiologists, KAHBPS = Korean Association of Hepato-Biliary-Pancreatic Surgery

recommending cholecystectomy due to its low specificity. Studies have shown that the ≥10 mm cutoff had sensitivity of 68.1%–98.2% but specificity of only 18.3%–70.2% for diagnosing neoplastic GBPs or GBC [9,10,71,72,79,101]. Furthermore, a 20-year cohort study found eight GBC cases in patients with GBPs ≥10 mm (n = 2055), suggesting an expected diagnostic yield of 0.4% (8/2055) [7]. Therefore, some researchers have suggested modifying the size criterion to 11–15 mm to improve specificity without significantly compromising the sensitivity [9,27,47,71,72,74,101]. The latest SRU recommendation has considered these findings and added additional size-based categories (10–14 mm, ≥15 mm) to evaluate whether cholecystectomy is indicated [12].

We concur with the established correlation between the 10 mm criterion and significant rates of neoplastic GBPs or GBC; however, we also recognize that this may lead to overtreatment. While some advocate for minimally invasive surgery because of its potential to reduce morbidity and mortality, particularly given the poor prognosis associated with GBC as along with its low incidence of complications, recent studies have documented short-term metabolic changes after cholecystectomy [102-104]. Furthermore, a cohort study has shown that the incidence of GBC in 10 mm GBPs is not high [7], and a meta-analysis estimated the median risk of malignancy in GBPs ≥10 mm to be 0.60% (99% credible range: 0.30%–1.16%) [26]. Studies have also demonstrated that the risk of neoplastic/malignant GBPs increases with size, even among GBPs ≥10 mm, with 13–15 mm GBPs having a higher malignancy risk than 10–12 mm GBPs [26,105]. Studies have reported increasing hazard ratios for GBPs ≥15 mm for both neoplastic GBPs and GBC, achieving specificity values from 77.4% to 93.3% with variable sensitivity (24.5%–83.3%) [9,27,33,47,65]. A few studies have also reported sensitivity values of 80.4%–100% and specificity values of 79.9%–95.6% for diagnosing GBC using cutoffs of 14 mm or >14 mm [72,74]. Given the high specificity of the ≥15 mm cutoff, we agree with the SRU recommendation and recommend cholecystectomy for GBPs ≥15 mm. We also recommend cholecystectomy for GBPs measuring 10–14 mm, considering the established relationship between GBPs ≥10 mm and neoplastic or malignant GBPs. Specifically, cholecystectomy should be performed for GBPs measuring 10–14 mm with

 https://doi.org/10.3348/kjr.2024.0914

concerning imaging features, whereas cholecystectomy should be considered optional for GBPs measuring 10–14 mm without concerning imaging features (Fig. 8). Although some studies have reported balanced sensitivity and specificity with 11–13 mm cutoffs [9,41,72,101], we propose optional cholecystectomy rather than adjusting the cutoffs for immediate cholecystectomy, considering measurement variability and the fact that the progression of neoplastic GBPs is not rapid. For GBPs measuring 6–9 mm with concerning imaging features, we also suggest optional cholecystectomy, adding a condition of age ≥50 years to enhance the diagnostic yield. For GBPs measuring 6–9 mm with concerning imaging features and GBPs measuring 10–14 mm without concerning imaging features that do not undergo cholecystectomy, we recommend the same surveillance protocol: biannual US for the first year, followed by annual US (Fig. 8). However, these recommendations require further validation. Finally, we emphasize that these recommendations are not suitable for patients with PSC or elevated CA 19-9 levels. For these patients, further diagnostic workups should be conducted and treatment options should be tailored at the individual level.

KQ 13. What are the Non-Imaging Risk Factors for GBC in Patients With GBPs?

S13-1: Old age, Asian ethnicity, and presence of PSC are known risk factors of GBC
S13-2: We do not recommend adjusting the risk of malignancy of GBPs in radiology reports based on these demographic risk factors except for tumor marker elevation
(Recommendation level: Strong; Evidence level: III)

Studies have reported a higher incidence of GBC in older age groups, often noting that age ≥50 or ≥60 years is associated with GBC [106]. Ethnicity and geographical risk factors have also been highlighted in studies, indicating a higher prevalence among Asian ethnicities, Native Americans, and Hispanics than among non-Hispanic whites, with a higher incidence of GBC in Asia and South America [107]. According to one study, the age-standardized GBC rate was the highest in East Asia (3.0/100000 py), followed by South America (2.8/100000 py), while it was lowest in Africa (0.35–0.74/100000 py) [108]. Female sex has also been reported as a risk factor for GBC (2.4 vs. 2.2 per 100000 py) [108]; however, when age-standardized, a Korean study showed a male-to-female ratio of 1:0.97 with a crude male-to-female ratio of 1:1.33 [109]. PSC is another risk factor for GBC. One study reported that approximately 16.7% (10/60) of patients with PSC and GBPs developed either GBC or adenoma with high-grade dysplasia during follow-up [110]. However, given the predominance of benign conditions in GBPs, these risk factors should be considered in the management planning of GBPs rather than in their differential diagnosis. Therefore, we do not recommend increasing the risk of GBPs without considering imaging features based solely on such demographics. Elevated levels of the tumor marker CA 19-9 suggest the likelihood of GBC and would be an exception in cases where it does not reflect clinical information on the differential diagnosis of GBP. However, definitive benign GBPs on US suggest that CA 19-9 elevation may be caused by medical conditions other than GBC.

KQ 14. Does the Presence of Gallstones Increase the Risk of Malignancy in GBPs?

S14-1: The presence of coexisting gallstones alone should not be considered indicative of a malignant GBP
S14-2: A careful US inspection of the GB should be performed to avoid blind spots and to accurately assess the malignant risk of GBP
(Recommendation level: Strong; Evidence level: III)

Several studies have suggested that the presence of gallstones may be associated with an increased risk of malignancy, including neoplastic polyps, in GBPs [36,37,39,50,61,111]. However, others found no substantial correlation between coexisting GB stones and neoplastic/malignant GBPs in multivariable analyses [6,29,30,33-35,40-42,45,46,49,52,54,62,69,80,112], and some even reported an association between gallstones and non-neoplastic GBPs [113]. Consequently, it remains unclear whether potential confounding factors have been adequately controlled in some studies. GBC is more frequently found in patients with gallstones, although its causality remains uncertain [114]. Therefore, it is uncertain whether the presence of gallstones directly increases the risk of malignant transformation in GBPs, independently increases the risk of de novo GBC development, or whether GBC and gallstones have the same etiology. Given the limitations of the current evidence, the

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Korean Journal of Radiology
KJR

presence of coexisting gallstones alone should not be used as an indicator of malignant or neoplastic GBP. Instead, a thorough examination of malignant features on US should be conducted to assess the risk of malignancy in GBPs, as well as to avoid blind spots caused by gallstones, since they often impair the adequacy of US visibility for GBP. For instance, in 34 patients with polypoid lesions in the GB (PLGs) without concomitant gallstones, US diagnosed PLG in 25 patients (73.5%) [36]. In contrast, among 66 patients with both PLGs and gallstones, US diagnosed PLG in only 11 (16.7%) [36]. Therefore, the coexistence of gallstones significantly decreases the sensitivity of preoperative US for detecting PLGs, which requires the attention of radiologists.

KQ 15. How Should GBPs be Described in Radiology Reports?

S15-1: Describe the presence of GBPs in the radiology report, regardless of size
S15-2: GBPs <6 mm without concerning imaging features should be reported as "likely benign"
S15-3: GBP size should be reported either as the actual size or in categorical terms indicating risks of malignancy (<6 mm; 6–9 mm; 10–14 mm; ≥15 mm)
S15-4: When present, features suggesting malignancy should be reported
Concerning imaging features: adjacent GBWT, sessility, or significant growth
(Recommendation level: Strong; Evidence level: N/A)

We recommend reporting the presence of GBPs in radiology reports, regardless of their size. This does not imply describing every GBP in patients with multiple GBPs. Instead, it refers to not omitting descriptions of GBPs that are small in radiology reports, although they are often clinically insignificant.

Although GBP size is the most important risk factor for neoplastic polyps or GBC, this information is sometimes missing from radiology reports. Studies have reported that the actual size description is present in only 71%–80% of reports [4,10,115]. This lack of information makes it difficult for physicians to determine appropriate management plans. Therefore, we strongly recommend describing the size of GBPs in radiology reports.

The size should be reported either as the actual size or using categorical terms that imply the potential risk of neoplasm or malignancy, rather than relying solely on qualitative terms such as "tiny," "small," or "large." In our recommendation, the relevant categories are <6 mm, 6–9 mm, 10–14 mm, and ≥15 mm. For GBPs ≥10 mm or those with an increase in size, we strongly encourage reporting the actual size of the GBP to facilitate communication among radiologists, referring physicians, and patients. For multiple GBPs, the largest GBP size can be used as a representative value to estimate the risk of malignancy.

In addition to polyp size, concerning imaging features and other features suggesting malignancies should be included when present. Although features such as sessility, adjacent GBWT, and significant growth are not specific signs of malignancy, the presence of these features may warrant adjustments to follow-up intervals or even consideration of surgical interventions in some patients. Similarly, documenting signs of benignity, such as multiplicity or comet-tail artifacts, in radiology reports can assist referring physicians in determining appropriate management plans and alleviating patient anxiety. Correspondingly, we recommend that radiologists prioritize benign entities in the differential diagnosis for GBPs <6 mm, except for patients belonging to specific risk groups such as those with PSC, since ample data have suggested that GBPs <6 mm without concerning imaging features are likely non-neoplastic [7,8,20,21]. This approach can help guide clinical decision-making and patient management effectively. The key considerations for radiology reporting are summarized in Table 3.

KQ 16. Is Follow-Up Required for GBPs <6 mm?

S16-1: Follow-up is not recommended for GBPs <6 mm without concerning imaging features
S16-2: For GBPs <6 mm with concerning imaging features, follow-up is recommended
Concerning imaging features: adjacent GBWT, sessility, or significant growth
(Recommendation level: Strong; Evidence level: I)

A cohort study conducted in South Korea found that 15 of 33 neoplastic polyps (45.5%) were <10 mm in size at the time of GBP diagnosis [66]. Because a smaller GBP size cutoff of 8 mm yielded only 72.4% sensitivity, the authors recommended careful observation of all small polyps. However, a study that reported malignancies in small GBPs (<6 mm) found that a

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Table 3. Key consideration for radiology reporting for GBP and GBWT

Considerations	Associated KQ
Description	
Describe the presence of GBPs in radiology report, regardless of size	15
Report the size of GBP in radiology report, either actual size or their size category (<6 mm, 6–9 mm, 10–14 mm, ≥15 mm)	12, 15, 16, 17
Report the longest diameter of GBPs in millimeters, rounding off decimal places	1
For multiple GBPs, use the largest size as the representative measurement	1
Describe GBP echogenicity relative to the adjacent GB wall	2
Report the presence of imaging features suggesting benignity when present	3, 15
Report the presence of concerning imaging features (adjacent GBWT, sessility, significant growth) when present	4, 5, 15
Describe GBWT as "equivocal" or "definite," or report actual thickness in millimeters	18
Differentials	
GBP size is the strongest determinant for differentiating neoplastic and non-neoplastic polyps	5
GBPs <6 mm without concerning imaging features are considered to be benign	3, 15
Vascularity on Doppler US is not pathognomonic for neoplastic GBPs	10
Do not upgrade the risk of GBPs without concerning imaging features solely based on patient demographics or medical history in a radiology report	11
Consider tumor marker (CA 19-9) for GBP differential diagnosis, noting benign-appearing GBPs may not cause elevation	11
ADM is suggested when symmetric GBWT shows intramural cysts, hyperechoic foci, comet-tail artifacts	23
The presence of ADM does not preclude the coexistence of GB cancer	23

GBP = gallbladder polyp, GBWT = gallbladder wall thickening, KQ = key question, GB = gallbladder, US = ultrasound, CA 19-9 = carbohydrate antigen 19-9, ADM = adenomyomatosis

cutoff of ≥5 mm had a specificity of only 7.7%, indicating a high false-positive rate [6]. Furthermore, these studies classified neoplastic polyps as malignancies, even though they are not equivalent to "malignant" polyps or GBC. Recent studies have also reported a low incidence of neoplastic polyps in histologically confirmed GBPs <6 mm [20,22,71]. In a 20-year cohort study, the incidence of GBC in patients with GBPs <6 mm was 1.3/100000 py [7]. Retrospective studies also reported no incidence of GBC in patients with small GBPs during follow-up (mean or median GBP size, 4–5 mm) [8,21,23,24,116]. GBPs <6 mm are likely to be stable or even shrink during follow-up [8,21,25,116]. Although Asian ethnicity is a risk factor for GBC, studies from Asian or multiethnic populations have reported extremely low incidence rates of neoplastic GBPs or GBC in patients with GBPs <6 mm [7,22,24,68]. Based on these findings, we do not support regular follow-up for patients with GBPs <6 mm because of the low diagnostic yield and expected low surveillance effectiveness (Fig. 8). For GBPs <6 mm with concerning imaging features, follow-up should be considered, and we recommend biannual US follow-up for the first year, followed by annual US follow-up for the next 4 years (Fig. 8). This is consistent with the recommendations of other societies regarding indications for follow-up in GBPs <6 mm [12-14,60]. This recommendation is not intended to address specific considerations, such as those in patients with PSC or those with elevated levels of tumor markers, such as CA 19-9. In these patients, further diagnostic workup should be considered, and the follow-up interval should be determined on an individual basis.

KQ 17. Is Follow-Up Necessary for GBPs Measuring 6–9 mm and What is the Appropriate Follow-Up Interval?

S17-1: For GBPs measuring 6–9 mm with concerning imaging features in patients <50 years or in patients ≥50 years without concerning imaging features, we recommend biannual follow-up for the first year and annual follow-ups for the next 4 years
S17-2: For GBPs measuring 6–9 mm without concerning imaging features in patients <50 years, we recommend annual follow-ups for 5 years
S17-3: If a GBP measuring 6–9 mm remains stable for 5 years, discontinuation of follow-up can be considered
S17-4: If significant growth is observed during follow-up, the management plan should be re-evaluated based on imaging features and other risk factors
Concerning imaging features: adjacent GBWT, sessility, or significant growth
(Recommendation level: Strong; Evidence level: III)

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Korean Journal of Radiology
KJR

In previous studies, neoplastic polyps measuring 6–9 mm were identified in GBPs [8,24,64,66,100,117]. Therefore, we recommend surveillance for GBPs within this size range and tailoring the interval according to imaging features and patient age. This recommendation aligns with other guidelines that advise follow-up for GBPs measuring 6–9 mm (or 7–9 mm) [5,12-14,60].

The surveillance interval is annual, unless there are concerning imaging features or the patient is aged ≥50 years (Fig. 8). In 6–9 mm GBPs with concerning imaging features in patients aged <50 years or without concerning imaging features in patients aged ≥50 years, we recommend biannual US follow-up followed by yearly US follow-up. The same surveillance strategy is applied to GBPs measuring 6–9 mm with concerning imaging features in patients aged ≥50 years if immediate cholecystectomy is not considered, as described in KQ 12. The surveillance interval was determined based on studies that followed up GBPs at intervals of 3–6 or 6–12 months which reported no occurrence of interval cancer, and most GBPs were stable during follow-up [6,70,95]. As biannual follow-up in the first year would exclude the possibility of malignant GBPs, annual follow-up would be sufficient after the initial biannual follow-up. This recommendation is consistent with several guidelines that suggest different follow-up intervals depending on the risk of malignancy (Table 4) [12-14,60].

We recommend considering discontinuation of follow-up in patients with stable GBPs after 5 years, which diverges from the guidelines set by the Korean Association of Hepato-Biliary-Pancreatic Surgery that advocates for continued long-term follow-up [5]. Our recommendation is based on a recent cohort study reporting that most GBCs were found in the first year of surveillance as well as a low rate of GBC in GBPs measuring 6–9 mm (unadjusted GBC rate: 8.7/100000 py) [7]. Although the time to progression from adenoma to carcinoma remains unclear, we anticipate a low diagnostic yield from the continued surveillance of stable GBPs measuring 6–9 mm over 5 years, making it reasonable to consider discontinuing follow-up in this group. In patients exhibiting changes in US features, such as significant growth or the emergence of other concerning imaging features, reassessment of management plans based on US features and clinical risk factors is crucial.

As stated previously, this is not recommended for patients with PSC or those with elevated CA 19-9. For these patients, further diagnostic workup should be performed, and the follow-up interval should be determined on an individual basis.

KQ 18. What is the Definition of GBWT?

S18: We define GBWT using two categories: equivocal GBWT (wall thickness 3–4 mm) and definite GBWT (wall thickness ≥5 mm or localized distinctive wall thickening >3 mm)
(Recommendation level: Strong; Evidence level: N/A)

There is no established consensus on the cutoff value for GBWT. One study reported the range of GBWT as 2.6 ± 1.6 mm in patients without GBLs [118]. In various studies, the threshold for GBWT often falls between 3 and 4 mm, whereas others have used a cutoff value of 5 mm [79,119]. The European multi-society guidelines use the criterion of >4 mm for localized GBWT [13], whereas the WFUMB, Canadian Association of Radiologists, and Gallbladder Reporting and Data System (GB-RADS) use >3 mm to define GBWT [14,60,120]. Therefore, we used two categories, equivocal and definite, to describe GBWT (Fig. 9). Although the former is less likely to be related to pathological GBWT and the latter may indicate pathological GBWT, we do not recommend using this parameter as an indicator of GBC risk. Notably, this description is not intended to accurately differentiate physiological, benign, and malignant conditions or to indicate the probability of GBC. Instead, the description aims to provide intuitive information about the degree of GBWT, in addition to the actual wall thickness, and to minimize the variance in qualitative descriptions among radiologists. To enhance qualitative categorization, radiologists may optionally report the actual wall thickness in millimeters, as recommended for GBP size measurement.

KQ 19. Is US With a High-Frequency Transducer Recommended for GBWT Detected on the US?

S19: US with a high-frequency transducer can be considered for further characterization in US-detected GBWT
(Recommendation level: Strong, Evidence level: III)

There is a paucity of literature investigating the added value of US applying a high-frequency transducer to conventional US side-by-side in patients with GBWT [87,88,121]. A direct comparison between the diagnostic

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Table 4. Follow-up indications for GBPs in guidelines

Guidelines	Indications	Surveillance
KSAR (2025)	10–14 mm GBP without concerning imaging features* (optional†)	Biannual US follow-up for the first year, then annual US follow-up for the next 4 years
	GBP measuring 6–9 mm with concerning imaging features* in patients ≥50 years (optional†)	
	GBP measuring 6–9 mm without concerning imaging features* in patients ≥50 years	
	GBP measuring 6–9 mm with concerning imaging features* in patients <50 years	
	GBP <6 mm with concerning imaging features*	
	GBP measuring 6–9 mm without concerning imaging features* in patients <50 years	Annual US follow-up for 5 years
SRU (2022)	Extremely low-risk GBP measuring 10–14 mm	US at 6, 12, 24 months
	Low-risk GBP measuring 7–9 mm	US at 12 months
	Low-risk GBP measuring 10–14 mm (optional†)	US at 6, 12, 24, 36 months
	Indeterminate-risk GBP measuring ≤6 mm (optional†)	US at 6, 12, 24, 36 months
ESGAR/EAES/EFISDS/ESGE (2022)	GBP measuring 6–9 mm without risk factors‡	US at 6, 12, 24 months
	GBP ≤5 mm with risk factors‡	
WFUMB (2022)	GBP measuring 7–9 mm without risk factors§	US at 6, 12, 24 months
	GBP measuring ≤6 mm with risk factors§	
CAR (2020)	GBP measuring 7–9 mm without risk factors‖	Annual US follow-up
	GBP measuring 7–9 mm with risk factors‖	Biannual US follow-up for first year, followed by annual US follow-up
KAHBPS (2010)	Unresected GBP	3–6 months US follow-up for first year, then annual US follow-up

*Adjacent gallbladder wall thickening, sessility, or significant growth, †US follow-up or cholecystectomy can be considered, ‡>60 years, PSC, Asian, sessile polypoid lesion including focal wall thickening >4 mm, §Indian ethnicity, PSC, features with high risk of malignancy on US, endoscopic US, contrast-enhanced US, ‖>50 years, sessile or single polyp, PSC, Indian ethnicity.
GBP = gallbladder polyp, US = ultrasound, PSC = primary sclerosing cholangitis, KSAR = Korean Society of Abdominal Radiology, SRU = Society of Radiologists in Ultrasound, ESGAR = European Society of Gastrointestinal and Abdominal Radiology, EAES = European Association for Endoscopic Surgery and other Interventional Techniques, EFISDS = International Society of Digestive Surgery-European Federation, ESGE = European Society of Gastrointestinal Endoscopy, WFUMB = World Federation for Ultrasound in Medicine and Biology, CAR = Canadian Association of Radiologists, KAHBPS = Korean Association of Hepato-Biliary-Pancreatic Surgery

performance of US with a high-frequency probe and conventional US is lacking. However, US using a high-frequency probe better demonstrates benign features such as intramural cysts or wall integrity than conventional US because of its higher spatial resolution [85,87]. Additionally, several studies have reported that the performance of US with a high-frequency probe is comparable to that of EUS for T-staging of GBC and MRI for differentiating ADM from GBC [86,87]. Therefore, we assume that these results can be extrapolated to the GBWT, given the theoretical advantages of the high spatial resolution offered by US with a high-frequency probe (Fig. 10). As previously stated, the term "US with a high-frequency transducer" does not refer to a specific probe type or scanner from a particular manufacturer. The objective of US with a high-frequency transducer was to achieve the highest possible spatial resolution. This was accomplished by optimizing the scan parameters and utilizing the techniques available for the US scanner. This approach is generally applicable to various US systems.

KQ 20. Is US Recommended for Incidentally Detected GBWT on CT or MRI, or Vice Versa?

S20-1: US can be considered if CT or MRI findings are inconclusive
S20-2: CT or MRI can be considered in cases of inconclusive US features, a limited sonic window, or suspected malignancy
(Recommendation level: Weak; Evidence level: IV)

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Korean Journal of Radiology
KJR

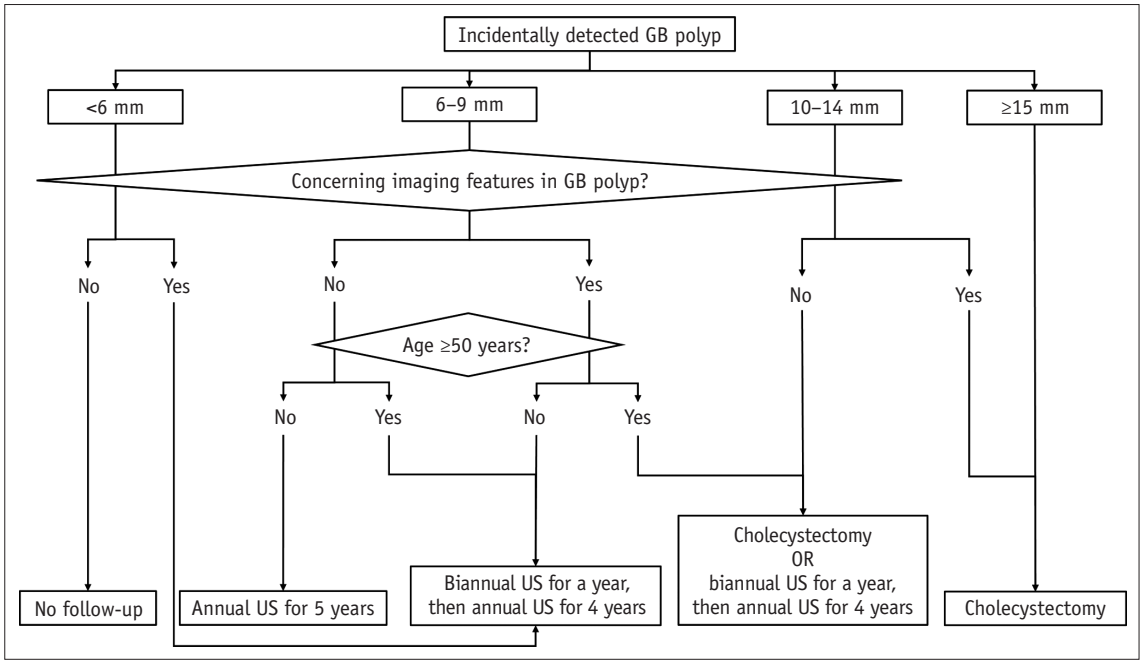

Fig. 8. Management algorithm of 2025 Korean Society of Abdominal Radiology recommendation for GB polyp. Concerning imaging features: adjacent GBWT, sessility, significant growth. GB = gallbladder, GBWT = gallbladde wall thickening, US = ultrasound

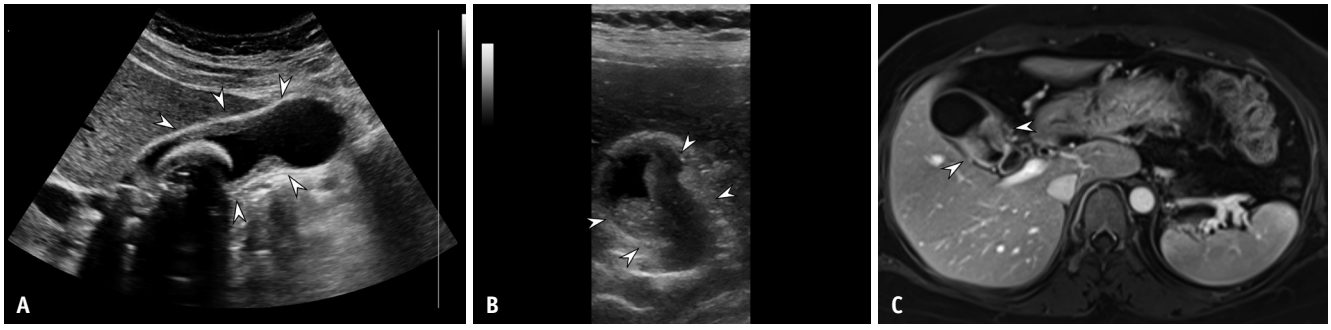

Fig. 9. Qualitative description of GBWT. **A:** A 48-year-old woman with a gallbladder stone exhibiting diffuse GBWT (arrowheads) measuring 4 mm, described as "equivocal GBWT." **B:** A 47-year-old woman with localized GBWT (arrowheads) measuring 9 mm in the gallbladder body, described as "definite GBWT." **C:** Contrast-enhanced MRI also reveals definite GBWT (arrowheads), which was surgically confirmed as gallbladder cancer. GBWT = gallbladder wall thickening

The literature comparing CT, MRI, and US directly for GBWT characterization is limited. Several studies have evaluated the performance of US in diagnosing GBWT or GBLs [91,122-126], whereas others have focused on the performance of CT in diagnosing GBWT or GBLs [124,127-130]. However, these studies were generally small and used a case-control design (xanthogranulomatous cholecystitis vs. GBC, ADM vs. GBC, or cholecystitis vs. others), which may have introduced bias. Although it is not possible to directly compare the diagnostic performance of each modality, US studies have reported a sensitivity range of 27.3%–87.5% and a specificity range of 27.3%–89.8% for identifying malignant GBWT or GBLs [91,122-124,126]. CT studies have shown a sensitivity of 72.2%–90.5% and a specificity of 64.3%–97.4% [124,127,129,130]. Studies have suggested that GBWT enhancement pattern is associated with the risk of GBC. Specifically, a single layer with heterogeneous enhancement and a two-layer enhancement pattern with strong inner-layer enhancement have been linked to GBC [130,131], although varying results have been reported [132]. In patients with ICPN, CT performed better than US [81]. Although the latest studies have reported better performance of MRI than US or CT [127,133], more evidence is warranted to recommend MRI over US or CT. Given the

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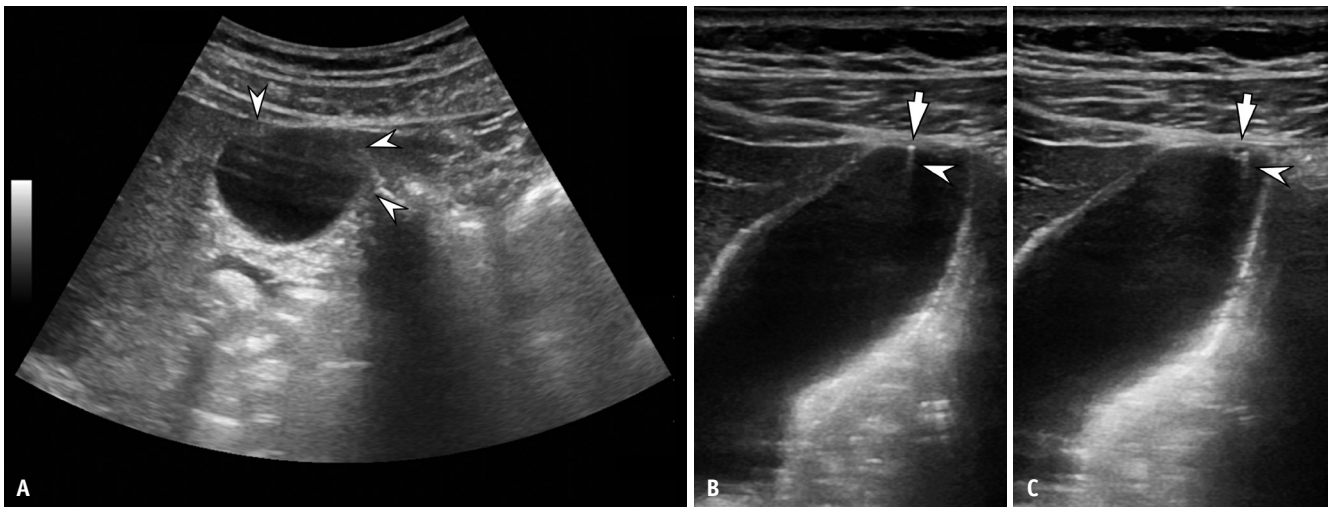

Fig. 10. US applying a high-frequency transducer for GBWT in a 67-year-old man. **A-C:** Equivocal GBWT was suspected on conventional US (**A**, arrowheads). When using a linear high-frequency probe on the same scanner, an intramural hyperechoic spot (**B**, arrow) accompanied by a comet-tail artifact (**B**, arrowhead) and an intramural cyst (**C**, arrow) with a comet-tail artifact (**C**, arrowhead) are detected, indicative of adenomyomatosis. US = ultrasound, GBWT = gallbladder wall thickening

lack of definitive evidence favoring one test over another, considering an alternative test when the initial results are inconclusive may aid in the characterization of GBWT. Additionally, CT or MRI may be beneficial for patients with a limited sonic window, and these modalities can be used to determine the extent of GBWT when a malignancy is strongly suspected. Therefore, we recommend considering CT or MRI for cases with indeterminate US features and US for cases with indeterminate CT or MRI features.

KQ 21. Is CEUS Recommended for Characterizing GBWT Detected on US?

S21-1: CEUS can be considered if US findings are not conclusive or limitedly evaluable
S21-2: CEUS is not recommended for definite malignancy or definite benign GBWT on US
S21-3: CEUS can be considered as a priority only if CT and MRI are not available or contraindicated
(Recommendation level: Weak; Evidence level: III)

Multiple studies have documented the efficacy of CEUS in evaluating GBWT and GBLs [38,122-124,132,134-140]. However, there is a paucity of studies that directly compare CEUS and US in characterizing GBWT. Imaging features indicative of malignancy include disruption of the wall (either the inner or outer layer), an infiltrative margin with the liver, intralesional vascularity, pattern of enhancement (homogeneous vs. heterogeneous), and early washout. A meta-analysis demonstrated that CEUS can differentiate between GBC and benign GBLs with a pooled sensitivity of 81% (95% CI: 77%–84%) and a pooled specificity of 87% (95% CI: 85%–89%) [139]. However, most of these studies had small sample sizes and employed retrospective or case-control designs, rendering them susceptible to bias. Furthermore, studies comparing CEUS and US in the same patients have often revealed superior diagnostic performance, particularly when high-resolution CEUS using a linear probe was compared to conventional US [122,123]. Therefore, it remains uncertain whether the improved results are due to the contrast agent or the use of a high-frequency transducer with a linear probe in US.

In this recommendation, CEUS was not prioritized over CT or MRI. Limited data are available comparing CEUS, CT, and MRI [124]. Theoretically, CEUS may offer advantages in identifying the enhancement pattern and layers of the GB wall in real-time; however, supporting data are limited. Therefore, CEUS should only be considered as the first option when CT and MRI are unavailable or contraindicated. Additionally, we do not recommend CEUS for cases with clearly benign or malignant GBWT identified by US. This recommendation is based on the minimal added value of CEUS in cases of definite benign GBWT on US, and because the added value of CEUS in GBC staging has not yet been established.

https://doi.org/10.3348/kjr.2024.0914

Korean Journal of Radiology
KJR

KQ 22. What is the Most Appropriate Follow-Up Interval and Modality for Indeterminate GBWT?

S22-1: Follow-up in 3–6 months using US is recommended for GBWT with an indeterminate risk of malignancy
S22-2: CT, MRI, and EUS can be considered as alternatives depending on the individual risk of malignancy, or in patients with limited sonic window
(Recommendation level: Weak; Evidence level: IV)

No relevant data are available regarding the follow-up interval for GBWT for indeterminate malignancy risk. GBWT can occur in conditions of acute or chronic inflammation, such as cholecystitis, or in reactive changes due to general medical conditions, such as cirrhosis. It can also appear as pseudothickening due to incomplete GB distension or in non-neoplastic conditions, such as ADM or GBC [141-143]. In non-acute settings, it is important to distinguish the early stages of GBC from benign conditions, such as chronic cholecystitis, ADM, and physiological changes that mimic a tumorous condition. The prevalence of GBC among incidentally detected GBWT cases in non-acute settings is unknown, and studies often overestimate the incidence of GBC owing to designs that typically require pathological diagnosis [144]. However, we believe that the overall incidence of GBC in patients with incidentally detected GBWT is low because GBC is a relatively rare disease entity, whereas GBWT is frequently observed on radiologic examinations and is caused not only by GB pathology but also by other medical conditions. Indeed, a recent study reported the incidence of GBC to be 3.4% (4/116) in patients with focal fundal GBWT [145], and another study reported the prevalence of GBC to be 3.8% (35/928) in a prospective cohort with GBWT [119]. Therefore, we recommend short-term follow-up instead of immediate intervention for incidentally detected GBWT. Considering the general tumor doubling time, a follow-up interval of 3–6 months appears sufficient to differentiate between malignant and benign conditions.

A recent statement regarding the use of GB-RADS recommended contrast-enhanced CT or MRI after a multidisciplinary team discussion of equivocal GBWT (GB-RADS 3) [120]. However, we recommend US as a primary follow-up imaging modality given its accessibility and capability to identify benign GBWT features (e.g., intramural cysts and echogenic foci) and features prompting suspicion of malignancy (e.g., irregular GBWT, wall disruption, or loss of layering) [14]. Additionally, the low incidence of GBC in non-acute settings further supports the use of US as the primary follow-up modality. In cases where US is limited by a poor sonic window or when the clinical suspicion of malignancy is high, CT, MRI, and EUS can be considered alternatives. CT and MRI are preferred over EUS because of their better patient compliance and non-invasiveness, whereas EUS is primarily considered for patients who are not candidates for CT or MRI.

KQ 23. Is Follow-Up Recommended for ADM?

S23-1: Follow-up is not required for ADM with typical imaging features
S23-2: If GBC and ADM cannot be clearly differentiated, follow-up with US, CT, or MRI is recommended
(Recommendation level: Strong; Evidence level: IV)

ADM is defined as the proliferation of the mucosal epithelium and the presence of an outpouching mucosa in the hypertrophied muscular layer, forming the Rokitansky-Aschoff sinuses. However, recent studies have reported the absence of muscular hyperplasia in ADM [146,147]. On US, ADM presents as a symmetric GBWT with intramural cysts, with or without echogenic foci and comet-tail artifacts [88]. Twinkling artifacts have been observed on Doppler US [148]. Traditionally, GB ADM has been considered benign. ADM may be linked to the development of GBC because both conditions share a background of chronic inflammation, which is a predisposing factor for GBC development. Although a few studies have reported neoplasms or GBC in patients with GB ADM [149,150], there is no solid evidence that ADM indicates a higher risk of GBC [151] and is generally regarded as a non-neoplastic condition [147]. Therefore, we do not recommend follow-up for ADM with typical imaging features. Concerns may arise from a recent study that reported neoplastic changes in 9.9% of ADM cases in a cholecystectomy cohort [147]. However, that study did not provide sufficient justification for recommending surveillance for patients with ADM; therefore, the potential benefits and feasibility of imaging-based surveillance remain unclear. Consequently, routine follow-up of patients with ADM with typical imaging features is not recommended. These guidelines should be updated in future studies, as the relationship between ADM and GBC becomes clearer.

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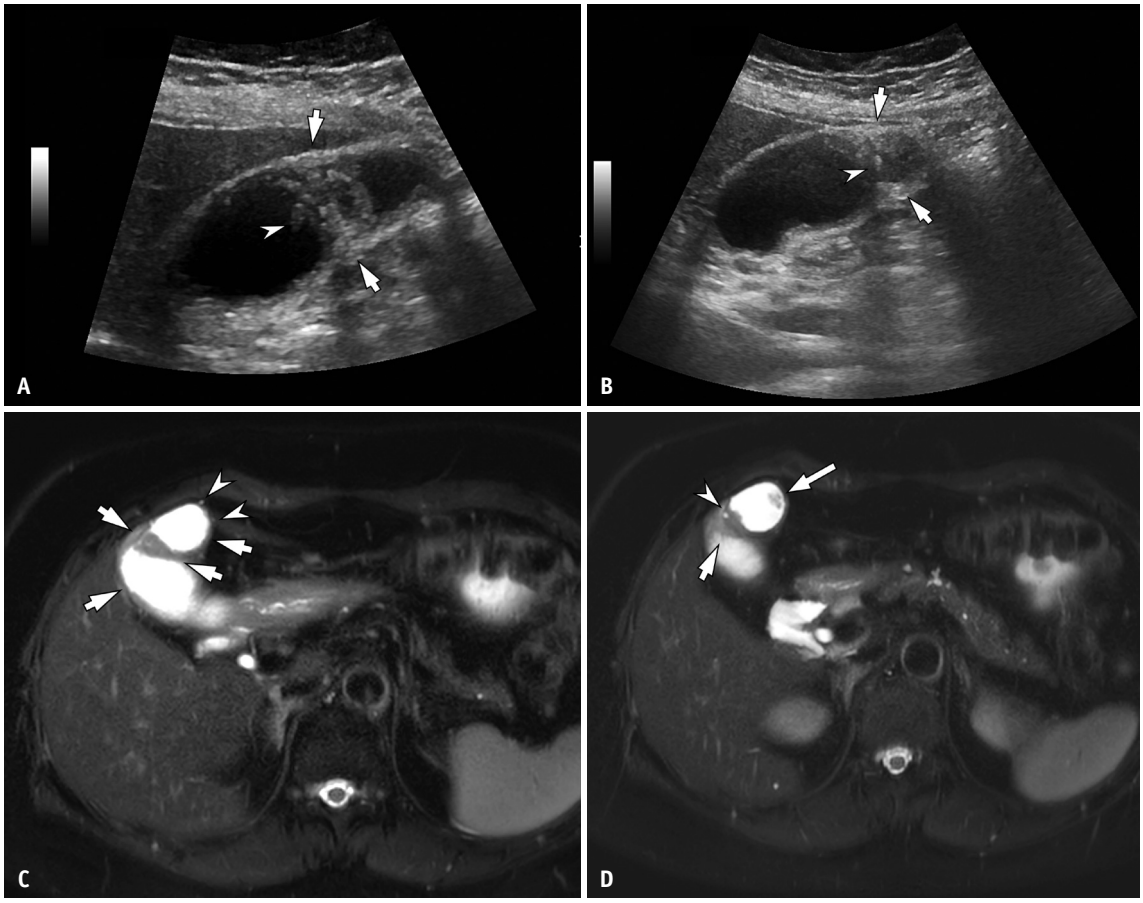

Fig. 11. Concomitant GB cancer with ADM in a 62-year-old woman. **A, B:** On ultrasound **(A, B)** GBWT (arrows) shows intramural hyperechoic spots with comet-tail artifacts (arrowheads) in the body **(A)** and fundus **(B)**, suggesting ADM. The patient underwent MRI owing to a 10 mm GBP in the fundus on US (not shown). **C, D:** On MRI, GBWT in the body and fundus (arrows) with intramural cysts (arrowheads) is observed with papillary GBP in the fundus (**D**, long arrow). Both the body and fundal lesions were surgically confirmed as GB cancer. GB = gallbladder, ADM = adenomyomatosis, GBWT = gallbladder wall thickening, GBP = gallbladder polyp

Aside from the lack of the need for surveillance for ADM, we urged radiologists not to prematurely exclude the possibility of concomitant GBC, even when typical features of ADM were observed on imaging during routine reading and US sessions, based on previous studies (Fig. 11) [55,147]. Furthermore, distinguishing between early GBC and ADM preoperatively poses a significant challenge [87,88,152]. One study also reported that patients with ADM were more likely to present with advanced stages of GBC than those without ADM, highlighting the challenge of differential diagnosis [153]. Although the presence of comet-tail artifacts and intramural cysts strongly indicates ADM [59], the sensitivity of US for the diagnosis of ADM has been reported to be 43%–80% [154]. Despite the scarcity of reports and lack of consideration of confounding factors, radiologists must be vigilant when evaluating patients with ADM to avoid misdiagnosing the wall thickening type of GBC and missing coexisting GBC. Therefore, if GBC and ADM cannot be clearly differentiated, a short-term follow-up is recommended. US is the primary imaging modality for follow-up; however, CT and MRI can also be utilized to detect Rokitansky-Aschoff sinuses, depending on the risk of malignancy and accessibility of CT and MRI [55,155].

KQ 24. What Examinations Should be Considered for Patients With a Limited Sonic Window?

S24-1: CT, MRI, or EUS should be considered in patients with an unspecified GBL on US for its characterization, and the selection of modality should be based on the individual risk of malignancy and the potential visibility of the GBL
S24-2: CT and MRI can be primarily considered for surveillance of GBLs
(Recommendation level: Weak; Evidence level: IV)

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Korean Journal of Radiology
KJR

There is no consensus on the most appropriate examination following US in patients with a limited sonic window, including EUS, CT, and MRI. EUS and MRI, which have relatively fewer concerns regarding GBL visibility, are considered alternatives to US. CT is another alternative that is particularly suitable for cases with less concern for GBL visibility. This is also advantageous because malignant GBWT enhancement patterns on CT have been well described in the literature [130]. According to a recent meta-analysis, there is insufficient evidence to suggest that EUS is superior to conventional US in differentiating between neoplastic and non-neoplastic polyps, as well as between benign and neoplastic or malignant polyps [156]. Therefore, our recommendations focus more on addressing visibility issues than on diagnostic performance.

In patients under surveillance, the risk of GBC is a key determinant in the selection of the follow-up modality. A personalized approach based on the malignancy risk of GBLs and patient demographics is essential. Among CT, MRI, and EUS, which were considered in the initial workup, we recommend either CT or MRI because these modalities are less invasive and are expected to result in better patient compliance. MRI with appropriate sequences is often prioritized over CT because it is free from radiation exposure and poses fewer concerns about GBP visibility, although the visibility of GBPs varies across studies [27,84]. Depending on the risk of malignancy and the size of the GBL, EUS can be considered for a one-time follow-up. However, we do not recommend EUS for long-term regular surveillance because of concerns regarding its invasiveness, patient discomfort, and costs.

CONCLUSION

GBPs and GBWT are prevalent clinical conditions that are often evaluated and followed up using imaging. We developed recommendations for GBPs and GBWT regarding radiology reporting, additional imaging workup (US, CT or MRI, and CEUS), and management protocols, including follow-up schedules and cholecystectomy, depending on the risk. Despite the low evidence levels of most recommendations owing to the lack of high-quality studies, we believe that these recommendations provide practical guidance based on current evidence. We acknowledge the need for further research on KQs, where consensus is limited. The guidelines will be updated as new evidence becomes available, requiring changes to this version of the recommendations.

Disclaimer

The 2025 Recommendations from the Korean Society of Abdominal Radiology (KSAR) for incidentally detected gallbladder polyps and gallbladder wall thickening were developed to guide the clinical management of these conditions, drawing on the latest published evidence for diagnosis and follow-up. These guidelines should not be interpreted as setting a standard of care, nor should they be considered inclusive of all proper methods of care or exclusive of other reasonably directed methods aimed at achieving the same results. Specific clinical practices in various real-world clinical situations may diverge from the 2025 KSAR recommendations; however, these guidelines do not interfere with or restrict these practices. These guidelines do not have a legal status or binding force, and the responsibility for patient care in actual clinical settings remains with the healthcare provider.

These guidelines reflect the best data available at the time of preparation. As medical knowledge is constantly evolving, future research may require revision of the recommendations of these guidelines. Healthcare providers should consistently consider the current evidence in conjunction with these guidelines when making clinical decisions.

Supplement

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Conflicts of Interest

The authors have no potential conflicts of interest to disclose.

Author Contributions

Conceptualization: Jeong Hee Yoon. Data curation: all authors. Funding acquisition: Jeong Hee Yoon. Investigation: all authors. Methodology: Jeong Hee Yoon. Project administration: Jeong Hee Yoon. Supervision: Jeong Hee Yoon. Visualization: Won Chang, Jeong Hee Yoon. Writing—original draft: Won Chang, Sunyoung Lee, Jeong Hee Yoon. Writing—review & editing: all authors.

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