



Ultrasound Imaging Criteria and Protocols for Active Surveillance of Low-Risk Thyroid Cancer: A Review of International Consensus Guidelines

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Given the indolent nature and favorable outcomes of papillary thyroid microcarcinoma (PTMC), active surveillance (AS) has been adopted as an alternative management option to immediate surgery. However, the meticulous selection of patients based on individual and tumor-specific characteristics, as well as ultrasound (US) findings, is crucial in AS. Regular US monitoring is performed during AS to detect indicators of tumor progression, such as growth, the emergence of new US features suggestive of gross extrathyroidal extension, and lymph node metastasis. Thus, imaging-based evaluations play a pivotal role in guiding the decision to continue AS or proceed with surgical intervention. This review introduces the Korean Society of Thyroid Radiology (KSThR) guideline for the standardized US imaging of patients with low-risk PTMC under AS, which provide practical recommendations for tumor assessment during the initiation and follow-up phases of AS. This review compared the key features of the KSThR guideline with those of major international guidelines and identified the similarities and differences in imaging methodologies and follow-up strategies. The primary objective of this review is to support the broader implementation of AS and improve outcomes for patients with low-risk PTMC by emphasizing imaging protocols.

Keywords: Active surveillance; Guideline; Thyroid cancer, papillary; Practice guideline; Ultrasound; Computed tomography

INTRODUCTION

The rapid increase in the prevalence of thyroid cancer can be attributed to the increased usage of medical imaging resulting in the detection of small thyroid cancers [1,2]. Papillary thyroid microcarcinoma (PTMC) is characterized by an indolent nature and excellent prognosis [3,4]; thus, active surveillance (AS) has emerged as an alternative to immediate surgery for the management of PTMC [5,6]. As a result, various international practice

guidelines currently recommend AS as a management option for patients with low-risk thyroid cancer [7-19].

AS involves careful imaging assessment of tumors at the time of disease presentation to facilitate the selection of appropriate candidates, and watchful waiting. While most of them are anticipated to be indolent, a small number of them could behave aggressively and progress during AS. Thus, careful imaging assessment of appropriate candidates, assessment of tumor progression, and the requirement for timely decisions regarding

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surgery are core issues in AS [20,21].

This review introduces the practice guideline set forth by the Korean Society of Thyroid Radiology (KSThR) for the standardized ultrasound (US) imaging of patients with low-risk PTMC under AS [22]. This guideline provides comprehensive recommendations for the US-based assessments performed during the initiation and follow-up phases of AS, including methods for evaluating tumor size, extrathyroidal extension (ETE), and lymph node (LN) metastasis. Furthermore, the KSThR guidelines were compared with key international guidelines to identify the similarities and differences in imaging methodologies, candidate selection criteria, and follow-up protocols. The primary objective of this article was to provide comprehensive insights into the KSThR and international consensus guidelines for the US evaluation under AS and optimize AS practices for the management of low-risk thyroid cancer.

INDICATIONS FOR ACTIVE SURVEILLANCE AND IMMEDIATE SURGERY

According to the KSThR consensus, AS may be a suitable management strategy for adult patients with low-risk PTMC (≤ 10 mm, Bethesda V or VI), whereas immediate surgery is recommended for the management of high-risk PTMCs exhibiting suspicious imaging features such as potential gross ETE, LN metastasis, and distant metastasis. Current guidelines generally recommend AS for the management of PTMC ≤ 1 cm without aggressive cytological subtypes, potential gross ETE, LN metastasis, or distant metastasis [10,14,15,19]. Nevertheless, the indications for AS remain controversial.

Only the safest candidates were selected for AS in previous Japanese studies [6,23] however, increasing experience with AS has led to the requirement for the expansion of the AS criteria [24-27]. The recommendations of the KSThR align closely with those of the Japan Association of Endocrine Surgery (JAES) consensus statement [10], which also recommends commencing AS for the management of papillary thyroid carcinoma (PTC) nodules confirmed as Bethesda V or VI with a size threshold of ≤ 10 mm. Notably, the French Society of Endocrinology-French Association of Endocrine Surgery-French Society of Nuclear Medicine (SFE-AFCE-SFMN) 2022 also recommends commencing AS for the management of microcarcinomas (≤ 10 mm) confirmed as Bethesda VI [14]. The Brazilian Society of Endocrinology and Metabolism (SBEM) 2022 consensus [18] and the Endocrine Task Force of the European Organization for Research and Treatment of Cancer (EORTC) [16] also recom-

mend commencing AS for the management of PTMC ≤ 10 mm, albeit without specifying the biopsy results. In contrast, the Canadian Thyroid Cancer AS Study Group has put forth a more inclusive size criterion, recommending the commencement of AS for the management of confirmed PTC nodules or suspected PTC nodules of up to 20 mm in size [20].

The necessity of performing biopsies for subcentimeter thyroid nodules without ETE or LN metastasis exhibiting suspicious US findings is a topic of debate as AS is being implemented more widely. AS was commenced following cytopathological confirmation historically [10]. However, the recommendations set forth by other guidelines vary [15-17,28]. A restrictive criterion would diminish the relevance of AS in certain settings, with similar AS outcomes being observed for biopsy-proven PTMC and nodules without biopsy confirmation [29]. The KSThR and Korean Thyroid Association recommends performing a biopsy of the most suspicious nodules regardless of the size in cases with suspected cervical LN metastases, obvious ETE to adjacent structures, confirmed distant metastases, or suspected medullary thyroid cancer. Additionally, biopsy is selectively advised for highly suspicious nodules classified as Korean Thyroid Imaging Reporting and Data System (K-TIRADS) 5 of >5 mm in size [19,30]. The JAES recommends performing a biopsy for nodules with US features strongly suggestive of malignancy; however, a size threshold has not been specified [10]. Notably, the SFE-AFCE-SFMN 2022 guidelines have adopted a more conservative stance and do not recommend performing fine-needle aspiration (FNA) for European Thyroid Imaging and Reporting Data System 5 nodules of ≤ 10 mm in size without US evidence of LN metastasis, gross ETE, or proximity to critical structures such as the recurrent laryngeal nerve (RLN) or trachea [14]. The EORTC does not specify US biopsy criteria, as the protocols set forth by European guidelines vary [16]. Similarly, the Canadian Thyroid Cancer AS Study Group (2021) [20] and SBEM 2022 guidelines [18] have not set forth explicit recommendations for the biopsy of subcentimeter nodules.

The KSThR consensus recommends AS for the management of Bethesda type V or VI nodules detected through FNA or core needle biopsy. However, AS may also be considered for the management of nodules with highly suspicious US findings, particularly when patient preferences are considered [22]. Table 1 lists the indications for AS set forth in the guidelines and prospective studies.

Table 1. Consensus Guidelines on US Imaging Criteria and Protocols for Active Surveillance in Low-Risk Thyroid Cancer

Consensus guideline	Biopsy result, tumor size	US criteria for biopsy of nodules ≤10 mm	US assessment for active surveillance appropriateness		US follow-up protocol	US criteria for conversion surgery
			Low-risk (active surveillance)	High-risk (immediate surgery)		
KSThR 2024 (Korea) [22]	PTC (Bethesda V or VI), K-TIRADS 5 nodules without biopsy, ≤10 mm	Most suspicious nodules regardless of the nodule size in cases with suspected cervical LN metastases, obvious ETE to adjacent structures, confirmed distant metastases, or suspected medullary thyroid cancer. Selective for K-TIRADS 5 nodules >5 mm	Ideal - Confined to the thyroid - No contact with the thyroid capsule and adjacent organs - No suspicious feature of LN metastasis or distant metastasis Appropriate - Anterior subcapsular tumors with a capsular abutment, capsular disruption or protrusion (no replacement) - Paratracheal tumors with acute angle abutment to the trachea - Posteromedial tumors showing preserved thyroid parenchyma between tumor and TEG - Posterolateral subcapsular tumors with capsular abutment - Tumors with ill-defined margin	Inappropriate - Anterior subcapsular tumors with replacement of strap muscle - Posteromedial subcapsular tumors with right- or wide- angle abutment to trachea - Posteromedial tumors with loss of normal parenchyma between TEG and tumor, or obvious protrusion - Posterolateral subcapsular tumors with obvious protrusion - Presence of biopsy- proven or clinical LN metastasis or distant metastasis	Every 6 months for the first 1–2 years and once a year thereafter if no tumor progression is detected	Growth to 13 mm (or 12 mm in two dimensions) Appearance of new features inappropriate for AS appear
JAES 2021 (Japan) [17]	PTC (Bethesda V or VI), ≤10 mm	Strongly suspicious for malignancy	AS can be considered for tumors located on the ventral thyroid that exhibit US features suggestive of suspicious invasion into the strap muscles, as well as for posterolateral subcapsular tumors with capsule abutment or posterior protrusion.	Presence of clinical LN metastasis or distant metastasis Clinically apparent invasion into the RLN or trachea Diagnosis of aggressive subtype of papillary thyroid carcinoma on cytology Tumors adherent to the trachea, possibly invading (obtuse angle) Tumors located along the course of the RLN (no normal rim of thyroid between tumor and course of RLN)	Every 6 months for 1–2 years after initiation of AS and once a year thereafter if no disease progression is detected	Tumor diameter reaches 13 mm Appearance of new LN metastasis
Canadian Thyroid Cancer AS Study Group, Prospective study 2021 (Canada) [21,26]	PTC or suspicious for PTC, ≤20 mm	Unspecified	Confined to the thyroid parenchyma Thyroid margin bulge without disruption of perithyroid echogenic line <7 mm nodule irrespective of relationship to trachea ≥7 mm nodule if acute angle to the trachea ≤7 mm nodule irrespective of relationship to TEG ≥7 mm nodule if thyroid rim present between the PTC and TEG No suspicious cervical lymph nodes	Known regional or distant metastatic thyroid cancer at the time of baseline evaluation LN(s) suspicious for metastatic disease (require biopsy confirmation) Adjacent to the RLN (lacking normal thyroid rim between TEG and PTC or protrusion of nodule to TEG or posteriorly) or trachea (≥7 mm if obtuse angle to the trachea) Loss of perithyroid echogenic line at site of contact of PTC Another type of thyroid cancer (e.g., poorly differentiated or other non-PTC thyroid malignancy)	At least every 6 months for 2 years, followed by yearly (if no evidence of disease progression)	Growth ≥3 mm in any one plane or maximal diameter Tumor growth in a location that is concerning (e.g., immediately adjacent to the trachea or in the course of the RLN) Incident development of metastatic PTC to LNs (confirmed on cytology or unequivocal imaging) Incident development of distant metastatic PTC (confirmed on imaging or biopsy or surgical histology)
SBEM 2022 (Brazil) [19]	PTC (unspecified biopsy results), ≤10 mm	Unspecified	Ideal - Solitary nodule - Well- defined margins - cN0, cM0 - No ETE Appropriate - Multifocal - Subcapsular location (not adjacent to RLN) - Background US findings	Inappropriate - Aggressive cytology - Subcapsular location adjacent to RLN - Obtuse angles between tumor and trachea - cN1, cM1 - Evidence of ETE	Every 6 months in the first 2 years and annually thereafter if no clinical or US changes	>3 mm in tumor size Growth of tumor to ≥13 mm Signs of (LN or distant) metastasis or ETE

(Continued to the next page)

Table 1. Continued

Consensus guideline	Biopsy result, tumor size	US criteria for biopsy of nodules ≤ 10 mm	US assessment for active surveillance appropriateness		US follow-up protocol	US criteria for conversion surgery
			Low-risk (active surveillance)	High-risk (immediate surgery)		
SFE-AFCE-SFMN 2022 (France) [14]	Microcarcinomas (Bethesda VI), ≤ 10 mm	Not recommended for EU-TIRADS 5 nodules ≤ 10 mm, without US evidence of LN metastasis or gross ETE, distant from the RLN and trachea	Ideal - Solitary microcarcinoma located at a distance from the thyroid capsule, the inferior laryngeal nerve and trachea, without suspicious LN metastasis	Contraindicated - Nodule close to capsule, inferior laryngeal nerve, with signs of macroscopic ETE or LN metastasis, followed by annual aggressive cytological type (tall cells, poorly differentiated...)	First US 6 month after initial diagnosis, then 6 months after that, followed by annual US until the end of 5th year, then at 7 years, 10 years and then every 2–3 years	Appearance of LN metastasis Signs of ETE Proven volumetric increase of nodule on 2 consecutive exams
EORTC 2023 (Europe) [13]	PTC (unspecified biopsy results), ≤ 10 mm	Not specified (variable according to the European guidelines)	Solitary thyroid nodule Well-defined margins No capsule contact (surrounded by a normal thyroid tissue rim) Not adjacent to RLN Tumors touching the trachea with acute angle between the tumor and trachea Absence of LN metastasis	Subcapsular, posterior, paratracheal location (tumors adjacent to (or invading) RLN, tumors invading or touching the trachea with an obtuse angle between the tumor and trachea) Extrathyroidal spread Lymph node metastases	Not specified	Not specified

US, ultrasound; KSThR, Korean Society of Thyroid Radiology; PTC, papillary thyroid carcinoma; K-TIRADS, Korean Thyroid Imaging Reporting and Data System; LN, lymph node; ETE, extrathyroidal extension; TEG, tracheoesophageal groove; AS, active surveillance; JAES, Japan Association of Endocrine Surgery; RLN, recurrent laryngeal nerve; SBEM, Brazilian Society of Endocrinology and Metabolism; SFE-AFCE-SFMN, French Society of Endocrinology-French Association of Endocrine Surgery-French Society of Nuclear Medicine; EU-TIRADS, European Thyroid Imaging and Reporting Data System; EORTC, Endocrine Task Force of the European Organization for Research and Treatment of Cancer.

ASSESSMENT OF APPROPRIATENESS BEFORE ACTIVE SURVEILLANCE

The KSThR guideline outlines detailed US-based criteria for assessing the appropriateness of selecting AS for the management of PTMC. Furthermore, this guideline introduces a US-based checklist for selecting eligible candidates for AS [22]. Patients can be classified into ideal, appropriate, and inappropriate categories based on the imaging findings, reflecting the suitability of implementing AS (Fig. 1) [31]. Patients categorized as ideal candidates for AS typically present with a probable or confirmed solitary PTMC confined to the thyroid parenchyma that is not located adjacent to the thyroid capsule (Fig. 1A). Appropriate candidates possess characteristics that make follow-up observations technically challenging (Fig. 1B). Treatment remains highly effective in these patients even in the event of tumor progression. Thus, surveillance is recommended for this group. AS is not suitable for inappropriate candidates owing to the potential for significant morbidity and higher recurrence risk after delayed surgery (Fig. 1C). Thus, immediate surgery is indicated for cases with locoregional or distant metastases, potential gross ETE identified at the time of initial presentation, or the emergence of new US features inappropriate for AS.

Other international guidelines have also proposed the implementation of similar three-tiered classification systems. For instance, the SBEM 2022 [18] and SFE-AFCE-SFMN 2022 [14] guidelines have proposed comparable approaches, categorizing cases as ideal, appropriate (or intermediate), or inappropriate (or contraindicated). In contrast, the JAES 2021 [10], Canadian Thyroid Cancer AS Study Group (2021) [20], and EORTC 2023 [16] have proposed a simpler binary classification, which classifies cases as suitable for AS or indicated for immediate surgery.

IMAGING EVALUATION BEFORE THE INITIATION OF ACTIVE SURVEILLANCE

A high-quality US examination of the thyroid and neck must be performed by an expert on thyroid imaging before commencing AS. US is the primary imaging modality used to evaluate thyroid nodules and determine the most suitable management strategy [32,33]. A thorough and high-quality US examination plays a critical role in patient selection and follow-up during AS [20–22]. US examinations must ensure comprehensive coverage of the thyroid gland and provide transverse and longitudinal grayscale and Doppler images of the thyroid and target nodules. US images of the neck compartments, including the central and lat-

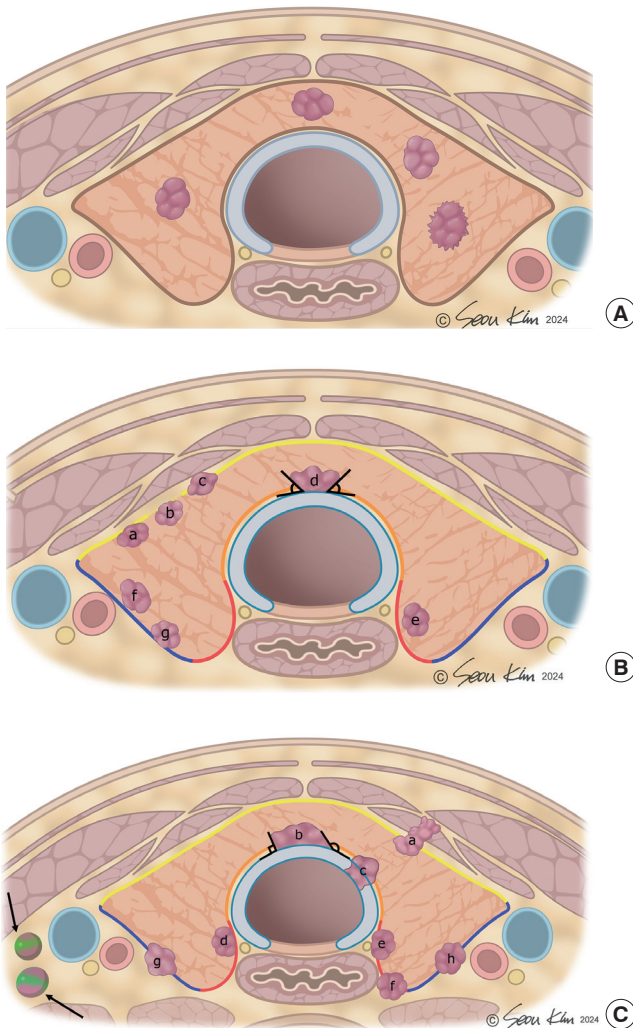


Fig. 1. Imaging-based appropriateness criteria for active surveillance in thyroid cancer (≤ 1 cm) proposed from the Korean Society of Thyroid Radiology. (A) Ideal tumors: tumors confined to the thyroid gland without contact with the thyroid capsule, no metastasis. (B) Appropriate tumors. Anterior subcapsular tumors (near the yellow line) showing capsular contact (a), disruption (b), and protrusion (c). Paratracheal tumors (near the orange line) abutting the trachea with acute angle (d). Posteromedial tumors (near the red line) without capsular abutment, preserving thyroid parenchyma between the tumor and the tracheoesophageal groove or posteromedial capsule (e). Posterolateral subcapsular tumors with capsular abutment (f, g). (C) Inappropriate tumors. Anterior subcapsular tumors (near the yellow line) demonstrating strap muscle replacement (a), paratracheal tumors (near the orange line) showing right- or wide-angle abutment to trachea (b) or obvious tracheal cartilage invasion (c), posteromedial subcapsular tumors (near the red line) with loss of normal thyroid parenchyma (d, e) or protrusion (f), and posterolateral subcapsular tumors (near the blue line) with obvious protrusion (g, h), biopsy-proven metastasis (arrows). Adapted from Lee et al. [22].

eral compartments, must be acquired in a consistent and meticulous manner [34].

Contrast-enhanced computed tomography (CT) of the neck also plays a supplementary role in detecting additional LN metastases in patients with low-risk PTMC [30,33]. The addition of CT to US improves the detection rate of LN metastasis in the central and lateral compartments [35–38] and may affect patient management decisions [39]. However, evidence regarding the additional value of CT in patients with PTMC under AS remains limited [40].

The lungs are the most common sites of distant metastasis in patients with differentiated thyroid cancer [17]. However, distant metastases are extremely rare in patients with low-risk PTMC [5,41–43]. Rare cases of lung metastasis have been reported; however, metastasis was absent at the time of initial diagnosis and detected only after recurrence in the neck in these cases [23]. These findings indicate that routine chest CT examinations are not necessary for identifying candidates for AS.

ULTRASOUND EVALUATION OF EXTRATHYROIDAL EXTENSION AND LYMPH NODE METASTASIS

Extrathyroidal extension

The accurate identification of gross ETE is a crucial step [20–22]. The emergence of gross ETE under AS is considered tumor progression. The KSThR consensus categorizes tumors requiring ETE assessment as anterior and posterior subcapsular tumors (tumors abutting the thyroid capsule) and paratracheal tumors (tumors in contact with the trachea) [22]. The medial half of the posterior subcapsular tumors can be further categorized as posteromedial subcapsular tumors, whereas the lateral half can be categorized as posterolateral subcapsular tumors. Fig. 1 demonstrates the ideal, appropriate, and inappropriate US features for AS. Patients with anterior subcapsular tumors accompanied by capsular abutments, capsular disruptions, or protrusions are appropriate candidates for AS. Patients with paratracheal tumors exhibiting an acute angle abutment to the trachea and posteromedial tumors without capsular abutment, preserving thyroid parenchyma between the tumor and the tracheoesophageal groove (TEG) or the posteromedial capsule, are also appropriate candidates for AS (Fig. 1B).

Anterior subcapsular tumors with strap muscle replacement, paratracheal tumors with right- or wide-angle abutment to the trachea, and posteromedial subcapsular tumors with capsular abutment or protrusion—exhibiting loss of normal parenchyma

between the tumor and the TEG or the posteromedial capsule—may demonstrate aggressive behavior or involve critical structures during AS. Thus, AS is not recommended for the management of patients with these tumors; immediate surgery should be considered in such cases (Fig. 1C).

The JAES 2021 [10] statement recommends commencing AS for the management of tumors located on the ventral thyroid or in the lateral capsule of the thyroid with US features suggestive of strap muscle involvement. However, AS is contraindicated for the management of tumors that adhere to the trachea or are located along the course of the RLN, especially in the absence of a normal thyroid rim between the tumor and RLN. In contrast, the Canadian Thyroid Cancer AS Study Group 2021 [20] also focuses on the size criteria. AS is recommended for the management of tumors confined to the thyroid parenchyma, tumors with a thyroid margin bulge without disruption, and tumors of <7 mm in size, irrespective of their relationship to the trachea. Larger tumors may be considered for AS if the angle with the trachea is acute and a normal thyroid rim is present. Immediate surgery is recommended for the management of tumors of >7 mm in size with an obtuse angle to the trachea, tumors adjacent to the RLN, and tumors exhibiting signs of extra-thyroidal spread. The SBEM 2022 [18] states that AS is ideal for tumors with no ETE and appropriate for tumors with a subcapsular location, provided they are not adjacent to the RLN. In contrast, tumors with evidence of ETE, such as subcapsular tumors adjacent to the RLN or those at an obtuse angle to the trachea, are inappropriate for AS. The SFE-AFCE-SFMN 2022 [14] recommends AS for the management of solitary microcarcinomas positioned away from critical structures, such as the thyroid capsule, inferior laryngeal nerve, and trachea. Tumors suspected of multifocality and those located near the thyroid capsule are considered intermediate candidates for AS. The EORTC 2023 [16] aligns with several other guidelines in that it recommends commencing AS for the management of tumors without capsule contact, tumors that are not adjacent to the RLN, and those at an acute angle abutment to the trachea. Immediate surgery is recommended for the management of tumors exhibiting signs of ETE or those located in the subcapsular, posterior, or paratracheal regions, especially if they are adjacent to the RLN or invade/ make contact with the trachea. These guidelines have similar frameworks; however, they emphasize slightly different factors such as tumor size or proximity to key structures, reflecting the diversity in AS strategies for the management of PTMC.

Lymph node metastasis

Clinically apparent LN metastasis, a significant risk factor for patients with PTMC [44], must be thoroughly assessed at the time of commencing AS, as well as during AS. The 2021 K-TI-RADS categorizes LNs based on US findings and FNA is recommended for suspicious metastatic LNs exhibiting any one of cortical hyperechogenicity, cystic changes, echogenic foci, and abnormal vascularity [30]. Inadequate evaluation of LNs before commencing AS can result in the requirement for extensive neck surgeries, higher morbidity, and reduced quality of life [22]. Therefore, the KSThR guideline provides detailed US-based criteria for the assessment of LN metastasis to determine the appropriateness of AS for the management of PTMC. This emphasizes that the presence of biopsy-confirmed or clinical LN metastasis, as well as distant metastasis, precludes AS and warrants immediate surgery (Fig. 1C). FNA with washout thyroglobulin measurement is recommended for any suspicious metastatic LNs, irrespective of their size.

The JAES, Canadian Thyroid Cancer AS Study Group, SBEM 2022, SFE-AFCE-SFMN 2022, and EORTC 2023 recommend immediate surgery for the management of patients with clinical or macroscopic LN metastasis. However, specific imaging criteria for identifying suspicious LNs and detailed recommendations for FNA are not provided. Table 1 lists the criteria for defining high-risk tumors requiring immediate surgery in various guidelines and studies.

TUMOR SIZE MEASUREMENT METHODS USED DURING ACTIVE SURVEILLANCE

Tumor growth is a marker of tumor progression in AS; thus, the acquisition of accurate, consistent, and reproducible measurements of tumor size is crucial in AS [20-22]. The three-axis measurement method proposed by the American College of Radiology is recommended for the acquisition of consistent tumor size measurements [45]. Notably, the same imaging planes and slices as those used for the previous measurements must be used while performing follow-up measurements. Thus, operators must consistently measure and report nodules to facilitate serial comparisons [22].

ULTRASOUND EVALUATION OF TUMOR PROGRESSION

Previous studies and guidelines typically characterize tumor progression by tumor growth, gross ETE, LN metastasis, and distant

metastasis [9,10,12,18,19]. However, variations have been observed in the criteria for tumor growth and enlargement. The most commonly used standard for tumor growth, i.e., an increase of ≥ 3 mm in the maximal tumor diameter [9,10,24,46,47], along with the criteria of growth of ≥ 2 mm in two dimensions (used in a recent multicenter PTMC cohort study [47–49]), was adopted herein.

IMAGING INTERVAL DURING ACTIVE SURVEILLANCE

Regular scheduling of US examinations plays an essential role in monitoring tumor enlargement or LN metastasis during AS. Patient visits were scheduled every 6 months for the first 2 years in most prospective studies; these visits transitioned to annual visits thereafter [24,46,48]. Various guidelines have outlined specific intervals for US examinations based on these practices (Table 1). The KSThR guideline recommends performing US follow-up examinations every 6 months during the first 1–2 years, followed by annual follow-up examinations for ongoing monitoring based on these protocols [22]. The JAES (2021), Canadian Thyroid Cancer AS Study Group (2021), and SBEM (2022) guidelines also recommend performing US examinations every 6 months during the first 1–2 years. Transitioning to annual assessments is recommended if disease progression is not observed, reflecting a common strategy of increased vigilance during the early stages of AS. The SFE-AFCE-SFMN (2022) guidelines also recommend scheduling follow-up examinations at 6-month intervals during the first year and transitioning to annual US assessments for up to 5 years. The SFE-AFCE-SFMN (2022) guidelines recommend scheduling follow-up examinations less frequently (every 2–3 years) after 10 years, emphasizing long-term monitoring. Notably, the EORTC (2023) guidelines do not specify a follow-up protocol, leaving the details to clinical discretion. Thus, the KSThR protocol aligns with the international standards, while its explicit timelines provide clear guidance for clinicians managing AS.

ULTRASOUND CRITERIA FOR CONVERSION SURGERY

Scheduling surgery for the management of PTMCs immediately after they exceed 10 mm may not be necessary, given that the progression rates of T1aN0M0 and T1bN0M0 PTCs do not differ significantly [25]. Thus, the decision to proceed with conversion to surgery must be made after careful deliberation and

considered separately with respect to ‘tumor growth.’ Specific criteria for conversion to surgery during AS for PTMC, including tumor growth to 13 mm in diameter (or 12 mm in two dimensions) and the emergence of new features that render the tumor inappropriate for AS, have been outlined by the KSThR 2024 guidelines [22]. These criteria are consistent with the JAES 2021 consensus statement [10] which recommends surgery in the event of the tumor diameter reaching 13 mm or the emergence of LN metastasis. The tumor growth threshold is also set as >3 mm or a size of 13 mm, with the addition of the emergence of LN metastasis as an indication for surgery in the SBEM 2022 consensus [18]. In contrast, the Canadian Thyroid Cancer AS Study Group (2021) [20] applies more sensitive criteria for tumor growth, which recommends surgical conversion for tumors showing growth of ≥ 3 mm in any plane, with growth in critical locations (e.g., adjacent to the trachea or RLN) or metastasis of PTC to LNs or distant sites. The SFE-AFCE-SFMN 2022 guidelines [14] define the criteria for surgical conversion as the emergence of LN metastasis, signs of ETE, or confirmed volumetric increase in the tumor on two consecutive evaluations, emphasizing the consecutive observation of tumor growth, given the inter-observer variability of US size measurements and variability in tumor volume kinetics. Notably, the EORTC 2023 [16] guidelines have not set forth criteria for surgical conversion, leaving it at clinical discretion.

CONCLUSIONS

The current KSThR consensus statement aimed to present a comprehensive guide for imaging assessment and clarify imaging methodology, despite the challenges of operator variability and uncertainties in the prognostic implications of US in AS. This review aimed to contribute to improved patient outcomes and a wider acceptance of AS in clinical practice by aligning imaging strategies with evidence-based recommendations.

CONFLICTS OF INTEREST

No potential conflict of interest relevant to this article was reported.

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