Supplementary materials

Candidate selection criteria for active surveillance (AS) (details of different guidelines)

1. ATA guidelines\(^2\): patients with very low risk tumors; patients at high surgical risk because of comorbid conditions; patients expected to have a relatively short remaining lifespan; patients with concurrent medical or surgical issues that need to be addressed prior to thyroid surgery.

2. KTA guidelines\(^15\): the same as the recommended ATA guidelines.

3. CATO guidelines\(^16\):
   3.1 Patients with non-high risk pathological variants
   3.2 Patients with tumor diameters ≤ 5 mm
   3.3 Patients with tumor distant from the thyroid capsule and not having invaded surrounding tissues
   3.4 Patients without evidence of lymph node or distant metastasis
   3.5 Patients without a family history of thyroid carcinoma
   3.6 Patients without a history of neck exposure to radiation during childhood or adolescence
   3.7 Patients with a low psychological burden who can actively cooperate.

4. Memorial Sloan Kettering Cancer Center\(^18\):
   Memorial Sloan Kettering Cancer Center developed a framework for the clinical decision making of PTMCs according to three domains (tumor/neck ultrasound characteristics; patient characteristics; medical team characteristics). They divided patients into three kinds of candidate for AS: ideal candidates; appropriate candidates; inappropriate candidates.

4.1 Ideal candidate
Tumor/neck ultrasound characteristics: solitary thyroid nodule confined to thyroid; ≤ 1 cm; well-defined tumor margins by ultrasound; surrounded by ≥ 2 mm normal thyroid parenchyma; previous US documenting stability; cN0; cM0.

Patient characteristics: medical minimalist; older patients (≥ 60 years of age); willing to accept AS understands that future surgery may be necessary (deferred intervention); understands that lymph node metastasis may be identified during the follow-up; compliant with follow-up plans; supportive of significant others (including other members of their health care team); life-threatening comorbidities or medical conditions requiring therapy.

Medical team characteristics: experienced team; expeditious evaluation by a multidisciplinary team; high quality neck ultrasonography; prospective data collection; tracking/reminder program to ensure proper follow-up.

4.2 Appropriate candidate
Tumor/neck ultrasound characteristics: multifocal papillary microcarcinomas; 1–1.5 cm maximal dimension; subcapsular location not adjacent to the RLN without evidence of extrathyroidal extension; ill-defined tumor margins; background ultrasonographic findings that will make follow-up difficult (thyroiditis, reactive lymph nodes, and multiple other begin appearing thyroid nodules); F-18 fluorodeoxyglucose (FDG) avid PTMC; an isolated BRAF V600E mutation.

Patient characteristics: minimalist/maximalist; middle-aged patients (18–59 years of age); extensive family history of papillary thyroid cancer; child bearing potential.

Medical team characteristics: experienced endocrinologist or thyroid surgeon; ultrasonography routinely available.

4.3 Inappropriate candidate:
Tumor/neck ultrasound characteristics: aggressive cytology features (rare); locations adjacent to the RLN/trachea; evidence of extrathyroidal extension; clinical evidence of invasion of the RLN or trachea (rare); N1 disease or M1 disease; high risk molecular profile; demonstrated increase of 3 mm diameter of a 50% increase in tumor volume over a relatively short time period.

Patient characteristics: medical maximalist; young patients (< 18 years of age); unlikely to be compliant with follow-up plans; not willing to accept an observation approach; severe anxiety regrading treatment.

Medical team characteristics: reliable neck ultrasonography not available; little experience with thyroid cancer management.
5. Kuma Hospital (contraindications for AS)\textsuperscript{21:}
   High risk features: presence of clinical node metastasis and/or clinical distant metastasis at diagnosis; signs or symptoms of invasion to the recurrent laryngeal nerve or trachea; high grade malignancy on cytology (e.g., tall cell variants and poorly differentiated carcinoma).
   Features rendering AS unsuitable: tumors attaching to the trachea; tumors located in the pathway of the recurrent laryngeal nerve.