Int J Clin Exp Pathol 2017;10(6):7223-7231
www.ijcep.com /ISSN:1936-2625/IJCEP0051576

Original Article

Warthin-like papillary thyroid carcinoma accompanying classical papillary carcinoma: report of three cases and systematic review of the literature

Eun Young Kim[1], Kwan Ho Lee[1], Yong Lai Park[1], Chan Heun Park[1], Dong Hyun Kim[2], Seoung Wan Chae[2], Ji-Sup Yun[1]

Departments of [1]Surgery, [2]Pathology, Kangbuk Samsung Hospital, School of Medicine, Sungkyunkwan University, Seoul, Korea

Received February 23, 2017; Accepted May 3, 2017; Epub June 1, 2017; Published June 15, 2017

Abstract: Background: We present three cases of Warthin-like papillary thyroid carcinoma (WLPTC) and perform a systematic review of the literature to evaluate the relationship between WLPTC and clinicopathological features. Methods: Relevant articles were obtained by searching the PubMed and KoreaMed databases using the following Medical Subject Headings (MeSH) terms and keywords: "Warthin papillary thyroid carcinoma". The following data were extracted from the eligible studies: age, gender, tumor size, lymphocytic thyroiditis, lymph node metastasis, extrathyroidal extension, multifocality, and BRAF mutation. Results: A total of 48 publications were identified, and 32 studies including the current study were ultimately included. A total of 164 patients were included in analysis. We found 31% of patients (51/164) had lymph node metastasis. Only four case reports described the histologic type of the metastasized lymph nodes. We found that lymph node metastases were primarily from classical PTC. Only one case of seven metastatic lymph nodes metastasized from WLPTC. We noted that five WLPTC tumors were accompanied by classical PTC on background. Conclusions: WLPTC does not metastasize to lymph node frequently and further studies of the mechanism of metastatic lymph nodes presenting a Warthin tumor-like pattern are needed.

Keywords: Carcinoma, papillary, thyroid (USP)

Introduction

The incidence of thyroid cancer is increasing globally [1]. Papillary carcinoma is the most common malignancy originating from the thyroid, and has an indolent clinical course conveying a more favorable outcomes than other variants. More than 10 variants of papillary thyroid carcinoma (PTC) have been reported [2]. Among multiple variants, Warthin-like PTC (WLPTC) is characterized by atypical oncocytic follicular cells lining papillary structures and dense lymphoid stroma. Since Apel et al. first reported WLPTC in 1995 [3], more than 100 cases have been reported. Due to the rarity of the disease, the information available on clinicopathological features such as age, gender, lymph node metastasis and prognosis is limited. Furthermore, the origin of metastatic lymph node (whether it comes from classical PTC or WLPTC) remains unclear. In this study, we describe three cases of WLPTC from our institution and aim to identify clinicopathological features of WLPTC using a systematic review of articles.

Materials and methods

Relevant articles were obtained by searching PubMed and KoreaMed databases using the following Medical Subject Headings (MeSH) terms and keywords: Warthin AND papillary AND thyroid AND carcinoma. Two reviewers (E.K. and J.Y.) independently searched articles on clinicopathological features with WLPTC. The review included studies published before July 2016. Duplicate articles were removed, and all were English language publications. All types of articles were considered except Editorials and Letters. The titles and abstracts of all searched articles were screened for the terms Warthin variant and papillary thyroid car-

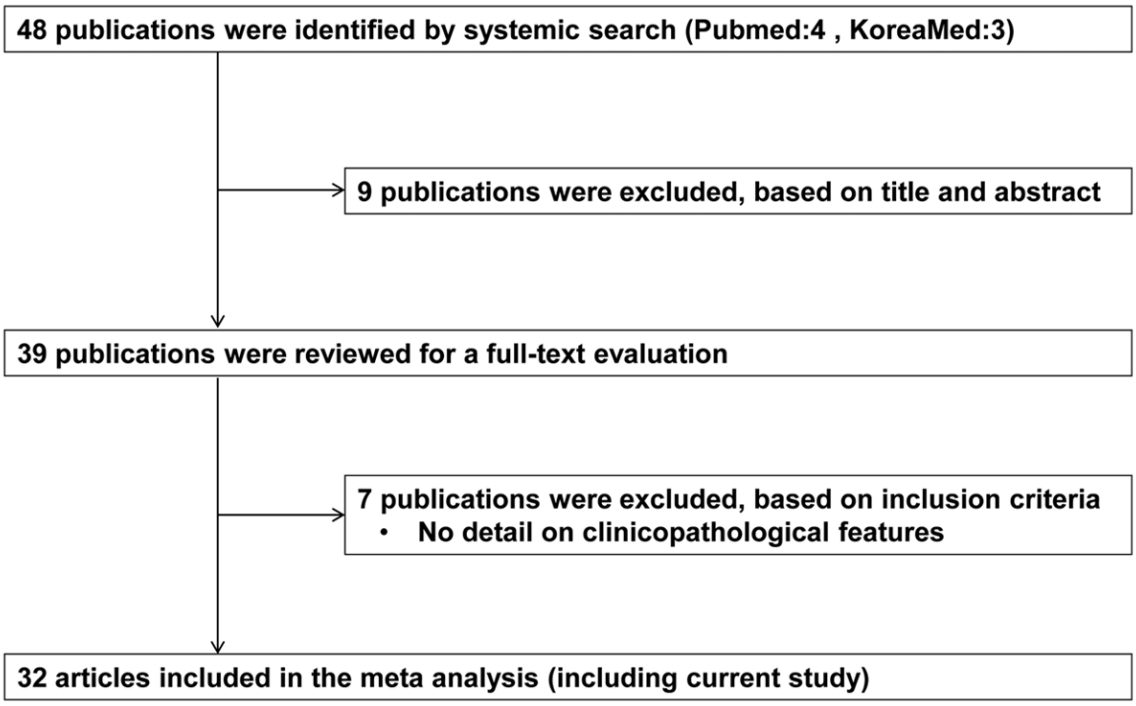

Figure 1. Article selection process.

cinoma and any terms associated with clinicopathological features: age, gender, sex, tumor size, lymphocytic thyroiditis, lymph node metastasis, extrathyroidal extension, extracapsular invasion, multifocality, and BRAF mutation. Selected articles were then further analyzed by a full text evaluation.

Results

As of July 2016, 48 publications were identified in the database search. Among the searched articles, 32 studies including our institution were ultimately included. A total of 164 patients were included for the analysis. The process of study selection is described in **Figure 1**. The first study was reported in 1995, and the latest study was reported in 2016. The largest study by Yeo et al. [4] included 40 patients. Only three studies were original articles [4-6], whereas the rest were case reports with a review of the literature. The age of onset ranged from 20 to 60 years and most patients were female. The mean tumor sizes ranged from 0.5 to 6.0 cm. The majority of the patients (n = 119, 72.4%) had lymphocytic thyroiditis, and 31% of patients (51/164) had lymph node metastasis. However, there were only 4 case reports describing the histologic type of the metastasized lymph nodes. Lymph node metastasis was primarily from classical PTC and there was only 1 case among 7 lymph node metastases that metastasized from WLPTC. There were three cases of WLPTC in background classical PTC including those at our institution. Three cases of WLPTC were diagnosed and surgically removed from March 2003 to May 2016 at our institution. All three cases were female. The histopathological findings of case 1 are depicted in **Figure 2**. The clinicopathological features of the patients from our institution and the systematic literature review are summarized in **Tables 1** and **2**, respectively.

Three cases of Warthin-like papillary thyroid carcinoma

Case 1: A 17-year-old female presented with neck area swelling and pain at our clinic. The symptoms had started one year prior and the patient did not have any previous medical history. The patient's mother had been diagnosed with and treated for thyroid carcinoma. Physical examination of the thyroid gland and neck area were unremarkable. Her cervical ultrasonography (US) examination revealed a suspicious nodule on her right thyroid lobe, abutting the anterior and lateral capsules. Suspicious lymph

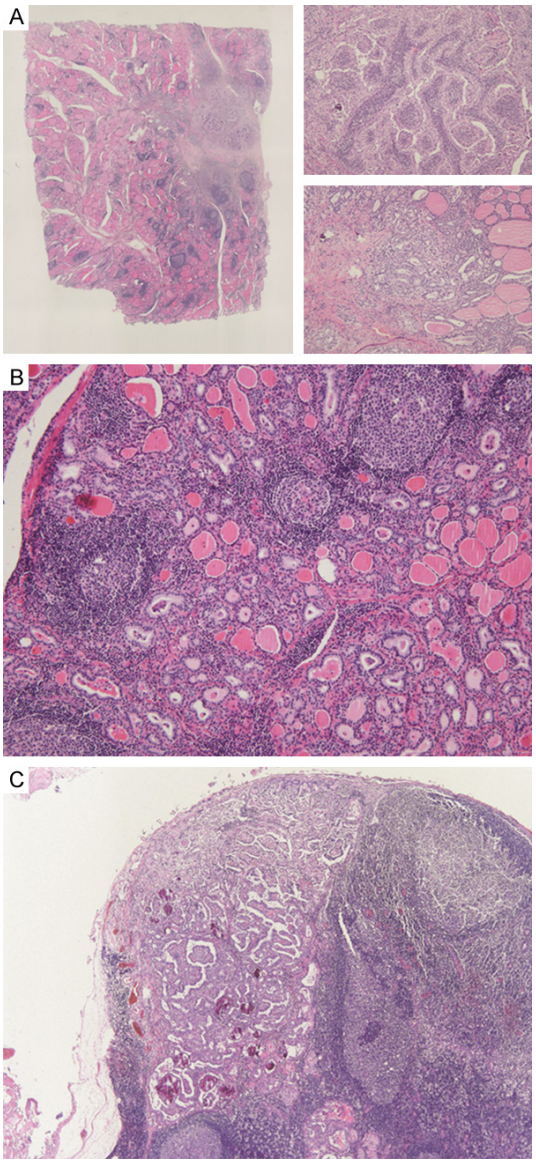

Figure 2. (Case #1): Histopathology of the Warthin-like variant of papillary thyroid carcinoma. A. Stitching image showing Warthin-like papillary thyroid carcinoma (upper inset ×100) abutting a classical papillary microcarcinoma (lower inset ×100). B. Background showing Hashimoto thyroiditis (×100). C. A lymph node demonstrating metastatic papillary carcinoma with a classical histologic pattern.

nodes were located on the ipsilateral side of the level VI lymph node.

Fine needle aspiration (FNA) cytology of the nodule was suspicious for malignancy (Bethesda category V). The patient underwent single-incision, endoscopic, trans-axillary, right hemithyroidectomy and ipsilateral central compartment node dissection (CCND). She did not have any intraoperative complications such as bleeding or nerve injury. The tumor was a relatively defined nodular mass with atypical oncocytic follicular cells lining the papillary structures with dense lymphoplasma infiltrations in the stroma and it abutted classical papillary microcarcinoma (**Figure 2**). The background thyroid parenchyma showed Hashimoto thyroiditis. Two lymph nodes of the central compartment were metastasized from the classical PTC. According to the American Joint Committee on Cancer (AJCC), the tumor was classified as pT3N1a, stage I. That patient was treated with levothyroxine in thyroid-stimulating hormone-suppressive doses.

Case 2: A 58-year-old female visited the local clinic with general weakness and fever with foreign body sensation in the neck area. She did not have family history of thyroid cancer, but had history of hyperthyroidism, which required medication to control. Cervical US revealed three suspicious nodules on the left thyroid gland, and the FNA result was suspicious for malignancy. The patient was then transferred to our hospital for surgical resection. Her US examination revealed suspicious nodules 0.7 cm, 1.7 cm and 0.7 cm in size on the left upper pole, left mid pole and left posterior mid pole, respectively, with multiple enlarged lymph nodes on the ipsilateral side of level VI. A thyroid function test showed no abnormalities. The patient underwent a bilateral total thyroidectomy with ipsilateral CCND. There were three separate tumors. The largest one was WLPTC and the other two tumors were classical PTC. Two nodules showed microscopic extrathyroidal extension and lymph node metastasis was not found. Three months later, the patient underwent ^{131}radioactive iodine therapy (100 mCi) and the post-treatment scan showed no abnormal uptake. At the two -year follow-up, the patient was asymptomatic, the cervical US was negative for recurrences, and the stimulated thyroglobulin was within the expected range.

Case 3: A 36-year-old female visited our clinic for evaluation of six-month history of fatigue. Her mother had a history of thyroid cancer and she did not have any personal medical history. Her physical examination showed no abnormal findings. Cervical US revealed a heterogeneous hypoechoic nodule, abutting the anterior capsule located in the left upper portion. Probable

Table 1. Clinical and pathological characteristics of patients with Warthin-like papillary thyroid carcinoma

	Case 1	Case 2	Case 3
Age/Sex	17/F	58/F	36/F
Tumor size, WLPTC (cm)	0.8×0.8	2.0×1.5	1.3×1.2
Tumor location, WLPTC	Right lobe, lower	Isthmus	Left lobe, mid
Tumor size, CPTC (cm)	0.2×0.2	0.7×0.6, 0.5×0.3	1.0×0.6
Tumor location, CPTC	Right lobe, lower[a]	Left lobe, mid, upper	Left lobe, lower
LN metastasis	2/10[b]	0/6	6/17[b]
Extrathyroidal extension	Present (Microscopic)	Present (Microscopic)	Present (Microscopic)
	WLPTC	WLPTC, CPTC	CPTC
Background pathology	Hashimoto thyroiditis	Hashimoto thyroiditis	None
$BRAF^{V600E}$ mutation	Absent	N/A	N/A
Family history of thyroid cancer	Present (Mother)	Absent	Present (Mother)
Type of surgery	Hemithyroidectomy	Total thyroidectomy	Total thyroidectomy
RAI ablation	No	Yes	Yes
Dose of RAI (mCi)	N/A	100	150

F = Female; FNA = Fine Needle Aspiration; LN = Lymph Node; N/A = Not Applicable; ETE = ExTrathyroidal Extension; RAI = RAdioactive Iodine; WLPTC = Warthin-Like Papillary Thyroid Carcinoma; CPTC = Classical Papillary Thyroid Carcinoma. [a]Abuts WLPTC. [b]The histology of all metastatic tumors is classic type PTC.

metastatic lymphadenopathy was also seen at levels III, IV and VI. The patient underwent bilateral total thyroidectomy, both CCND and modified radical neck dissection (MRND). In the mid portion of the left lobe, a well-defined nodular lesion showed atypical oncocytic follicular cells lining papillary configuration with abundant lymphoplasma collections. There was a separated tumor of classical papillary carcinoma with infiltrative tumor border. There were multifocal lymph node metastases to the left level VI (3/3), right level VI (1/5), left lateral neck (1/4) and right lateral neck (1/5). The metastatic foci were classical papillary carcinoma. Two months later, the patient underwent ^{131}radioactive iodine therapy (150 mCi) and was then treated with levothyroxine in thyroid-stimulating hormone-suppressive doses.

Discussion

WLPTC was first reported in 1995, and characterized by follicular epithelial differentiation with distinctly papillary architecture, oxyphilic cytology and lymphoplasma infiltrations in the stroma [3]. WLPTC is considered a subtype of the oncocytic variant with abundant lymphoplasma infiltrations and are frequently accompanied by Hashimoto's thyroiditis. Diagnosis is mostly based on the nuclear features of PTC [7, 8]. The prevalence of WLPTC is relatively uncommon and the pathological characteristics are based on more than 100 case studies. The prognostic outcomes such as overall and progression-free survival rates are known to be similar compared to classical PTC [9].

A previous case series of WLPTC is described in **Table 2**. The age of onset ranged from 20 to 60 years and most patients were female. Most cases were associated with lymphocytic thyroiditis and the rate of lymph node metastases varied among the studies. WLPTC was more common in females and occurred predominantly in elderly women [9]. The mean age of the three patients in our institution was 37 years. However, the age of one patient (17 years old) reported herein is one of the youngest among those reported in the literature, indicating that WLPTC can appear in young patients.

The relationship between WLPTC and lymphocytic thyroiditis is complex. After systematic review, we found that most studies in the literature (22/32) reported a background of lymphocytic thyroiditis (**Table 2**). Two patients also showed background lymphoplasma infiltration (**Figure 2**). The pathophysiology of lymphoplasma infiltration remains unclear. However, it could be hypothesized based on the association between chronic lymphocytic thyroiditis and PTC. Several studies have suggested that lymphocytic infiltration in non-tumor-bearing thyroid tissue was activated through an autoim-

Table 2. Previously reported case series of Warthin-like papillary thyroid carcinoma

Study	Number of patients	Age (y) mean ± SD or median (range)	Female (%)	Tumor size (cm) mean ± SD or median (range)	Lymphocytic thyroiditis (%)	Lymph node metastasis (%)	Extrathyroidal extension (%)	Multifocality (%)	BRAF mutation (%)
Apel et al. (1995) [1]	13	40±14.4	12 (92)	3.0±0.9	9 (69)	3	N/A	N/A	N/A
Yousef et al. (1997) [2]	2	37 (17-58)	2 (100)	2.0 (1.8-2.2)	2 (100)	1 (50)	N/A	N/A	N/A
Kim SR et al. (1997) [3]	1	33	1 (100)	2.0	1 (100)	1 (100)	N/A	N/A	N/A
Vera-Sempere et al. (1998) [4]	1	31	1 (100)	2.5	1 (100)	0 (0)	N/A	N/A	N/A
Fadda et al. (1998) [5]	1	31	1 (100)	1.5	0 (0)	0 (0)	N/A	N/A	N/A
Vasei et al. (1998) [6]	1	50	1 (100)	3.0	0 (0)	0 (0)	N/A	N/A	N/A
Baloch & LiVolsi et al. (1998) [7]	2	40±5.6	2 (100)	2.55±0.1	1 (50)	1 (50)	N/A	1 (50)	N/A
Tazawa et al. (1999) [8]	4	50 (49-53)	4 (100)	1.9 (1.5-3.0)	4 (100)	4 (100)	N/A	N/A	N/A
Imamura et al. (1999) [9]	1	52	1 (100)	1.7	1 (100)	0 (0)	N/A	N/A	N/A
Sarkady et al. (1999) [10]	1	35	1 (100)	3	1 (100)	1 (100)	N/A	N/A	N/A
D'Antonio et al. (2000) [11]	3	50±6.5	2 (50)	1.4±0.1	3 (100)	0 (0)	N/A	N/A	N/A
Baloch & LiVolsi et al. (2000) [12]	17	42±10.0	15 (88)	2.4±0.9	17 (100)	3 (17)	N/A	N/A	N/A
Ludvikova et al. (2001) [13]	12	64±11.4	11 (92)	2.7±0.1	11 (92)	2 (17)	N/A	N/A	N/A
Urano et al. (2001) [14]	1	52	1 (100)	4	0 (0)	1 (100)	N/A	N/A	N/A
Chang et al. (2004) [15]	1	41	1 (100)	1.5	1 (100)	0 (0)	N/A	N/A	N/A
Lam et al. (2005) [16]	1	74	1 (100)	5.0	0 (0)	1 (100)	N/A	N/A	N/A
Trovisco et al. (2005) [17]	8	50±4.5	7 (87)	1.7±0.3	N/A	N/A	N/A	N/A	6 (75)
Kim HH et al. (2006) [18]	5	52±13.2	5 (100)	1.5±0.5	4 (80)	0 (0)	N/A	N/A	N/A
Abrosimov et al. (2007) [19]	9	42±1.8	8 (89)	1.9±2.2	N/A	N/A	N/A	N/A	N/A
Amico et al. (2010) [20]	1	79	1 (100)	6.0	1 (100)	1 (100)	N/A	N/A	N/A
Panayiotides IG et al. (2010) [21]	1	51	1 (100)	1.0	1 (100)	0 (0)	N/A	N/A	N/A
Paker I et al. (2012) [22]	1	47	1 (100)	3.0	1 (100)	0 (0)	N/A	N/A	N/A
Paliogiannis et al. (2012) [23]	1	22	1 (100)	1.8	1 (100)	0 (0)	N/A	N/A	N/A
Ersen et al. (2013) [24]	4	39±15.2	3 (75)	1.7±0.5	4 (100)	0 (0)	N/A	3 (75)	N/A
Chong et al. (2014) [25]	1	31	1 (100)	0.9	1 (100)	0 (0)	1 (100)	N/A	N/A
Yeo et al. (2015) [26]	40	46 (18-77)	35 (87)	1 (0.4-2.2)	32 (80)	18 (45)	9 (22)	15 (37)	26 (65)
González-Colunga et al. (2015) [27]	1	36	1 (100)	1.7	0 (0)	1 (100)	N/A	N/A	N/A
Han F et al. (2015) [28]	1	65	1 (100)	0.5	0 (0)	0 (0)	0 (0)	N/A	1 (100)
Padma S et al. (2015) [29]	1	21	1 (100)	1.5	N/A	1 (100)	0 (0)	1 (100)	N/A
Jun HH et al. (2016) [30]	16	44±11.2	15 (94)	0.8±0.5	11 (69)	6 (37)	N/A	N/A	N/A
Kim et al. (2016) [31]	9	52±15.6	8 (89)	1.5±0.4	9 (100)	3 (33)	1 (11)	2 (22)	N/A
Current study	3	37±20.5	3 (100)	1.3±0.6	2 (66)	3 (100)	3 (100)	2 (66)	1 (33)
Total	156								

SD = standard deviation.

mune mechanism by the development of PTC [10, 11]. The RET/PTC fusion gene has also been involved in this association [12]. Another theory is that this lymphocytic infiltration serves as a host immune response to the tumor [13]. Since most cases of WLPTC are accompanied by background lymphocytic thyroiditis, it is necessary to differentiate WLPTC from thyroid disease with dominant lymphocytic infiltration such as Hashimoto's disease, malignant lymphoma, diffuse sclerosing and tall cell variant (TCV) of PTC [14]. To avoid misdiagnosis, it is important to confirm the absence of follicular cells with pseudoinclusions. Other benign entities can present with moderate cellular atypia, oncocytic change, nuclear grooves, and ground-glass appearance [15]. TCV exhibits tall columnar cells with a longitudinal length twice their cross-wise length. Our cases did not have any of the characteristics of Hashimoto's thyroiditis or TCV of PTC. Since WLPTCs are often misclassified as classic, tall cell, or oncocytic variants, the incidence of WLPTC could be underestimated [16]. For example, a recent Korean study by Jun et al. reported only 16 cases (0.2%) of WLPTC from 8,179 PTC patients [5]. Another source of underestimation may be due to lack of care taken by the pathologist during observation of the specimen. As an example, even though classic PTC and WLPTC show a similar growth pattern, the papillary cores of the classic variant do not show marked infiltration of lymphocytes and plasma cells [7, 16].

The presence of lymph node metastasis is common characteristic of WLPTC. After systematic review of articles, we found 31% of cases (51/164) were accompanied by lymph node metastasis and this rate was similar to that of classical type, in which one-third of patients presented with nodal metastasis at the time of diagnosis [17]. In spite of the relatively high incidence of lymph node metastasis, it is unknown whether lymph node metastasis of WLPTC originates from classical PTC or Warthin tumor-like pattern. Only four case reports have described the histologic type of metastasized lymph nodes. One report described that psammoma bodies present in cervical lymph node metastases and in the other case, the tumor infiltrated the entire lymph node, demonstrating typical Warthin-like characteristics [9]. A second report described metastatic lymph nodes having nuclear features of classical PTC and also found that recurrent metastatic lymph nodes one year after the initial surgery were identical to the primary lesion [14]. Lam et al. also reported that FNA of metastatic lymph node showed features consistent with classical PTC [18]. Lastly, Amico et al. found a dedifferentiated component in the tumor mass, however this component was not identified in ten regional metastatic lymph nodes [19]. At our institution, all lymph node metastases were from classical PTC, not Warthin-like type. In summary, lymph node metastases were primarily from classical PTC and among 7 lymph node metastases, only 1 case metastasized from WLPTC. After systematic review, we found that WLPTC does not metastasize to lymph nodes frequently. In the future, further study into the mechanism of metastatic lymph nodes presenting with a Warthin tumor-like pattern is needed.

A high detection rate of $BRAF^{V600E}$ mutation was noted in cases of classical PTC [20], and in the literature, nearly 75% of WLPTC expressed the $BRAF^{V600E}$ mutation [21]. The mutation of valine to glutamic acid at residue 600 of the BRAF gene plays a crucial role in the pathogenesis of PTC. The mutation is certainly detected in PTC with a papillary or mixed papillary/follicular structure such as classical, Warthin-like and oncocytic variant [21]. One previous study reported the BRAF mutation in 75% of WLPTCs [20]. In our case, the 17-year-old female did not have a BRAF mutation. One hypothesis is that tumors with BRAF mutation begin their neoplastic changes in later decades. Taken together, our result is in accordance with the fact that the BRAF mutation does not always appear as stimulus for development in WLPTC.

The role of FNA or immunohistochemistry staining in the diagnosis of WLPTC is unknown. Differentiation of WLPTC from classical PTC is difficult; the oncocytic variant PTC and Hurthle cell neoplasm are difficult. Hurthle cells with inflammatory cells in FNA specimen can also be detected in Hurthle cell nodules or neoplasms arising in a background of chronic lymphocytic thyroiditis [22]. Since Hurthle cell neoplasm has cytoplasmic and nuclear features that overlap with those of classical PTC, histopathologic specimens are needed for diagnosis. It is challenging to differentiate WLPTC from dominant lymphocytic infiltration on FNA cytology [23]. There have been reports that immunohistochemistry staining can demonstrate that the epithelial cells lining the papillae are immunoreactive for cluster of differentia-

tion (CD) 15 (Leu M1) and papillary stalks were positive for CD4+ lymphocytes [24]. Immunohistochemistry may be helpful, but does not provide a definite method for diagnosis of WLPTC.

After a systematic review of articles, we found that a mixed pattern of WLPTC and classical PTC in a single mass is rare. In one case report, Warthin tumor-like PTC with a minor (5%) dedifferentiated component was described [19]. In addition, Lam and colleagues reported WLPTC undergoing anaplastic changes [18]. Both cases had common pathologic features in which ovoid tall cells and marked nuclear atypia were noted. A high MIB-1 labeling index (7% vs. 20%) and large necrotic foci were other common features. In both cases, a mixed pattern with a dedifferentiated component showed worse prognosis and tumor aggressiveness, compared to classical PTC. In another report, there was mixed pattern of WLPTC with classical PTC [14]. They found an area of follicular formation or papillary structure, as in conventional PTC, in part of the tumor. Two of our cases were accompanied by classical PTC on background. In summary, it is rare for WLPTC and classical PTC to coexist as a mixed pattern in a single tumor mass.

Several studies have reported the coexistence of multiple variants of PTC. After a systematic review of articles, we found 12% of patients (21/164) had multifocal PTCs. Most variants other than WLPTC were classical PTC. One case report revealed a 1-cm WLPTC and a nearby 0.7-cm classic PTC [25]. A case report by Ersen et al. showed multifocality in four WLPTC patients (2: classic, 1: follicular, 1: oncocytic) [26]. Mai and colleagues have also reported the coexistence of tall cell and Warthin-like papillary in four PTC patients [27] Kim et al. reported two patients with multiple PTC in the ipsilateral lobe, and both patients had classical PTCs accompanied by WVPTC [6]. Two of our cases were multifocal. Many other studies have reported the coexistence of WLPTC and other variants of PTC in the same patient [4, 22, 28]. Due to the heterogeneity of PTCs, unusual or rare histologic variants may be seen in the same tumor. However, it is not entirely understood whether multifocality is a risk factor for aggressiveness or a predictor of prognosis of WLPTC [7].

The prognosis of WLPTC has been reported to be similar to that of classical PTC. Except in one case report, where WLPTC coexisted with anaplastic changes and tall cell, WLPTC had an indolent disease course in general [18, 27]. During the follow-up period (typically about one year), no local recurrence or distant metastasis was reported. Studies with long-term follow-up are needed to assess survival outcomes of WLPTC patients. There were several limitations to this study. In terms of outcome, there is a risk of bias, and at the review level there might have been incomplete identification of pertinent research and a reporting bias. Second, this study lacked follow-up, so the prognosis of WLPTC remains inconclusive.

In summary, WLPTC is a rare variant of PTC and its histopathological features are distinct and unique. It was difficult to diagnose WLPTC using conventional techniques such as US, computed tomography and physical examination. FNA or US finding can result in misdiagnosis as classical PTC or benign nodules [6]. Histopathologic confirmation of lymphoplasma infiltration in the papillae stalk is critical. We also found that WLPTC does not frequently metastasize to lymph nodes. In the future, further studies into the mechanism of lymph node metastasis presenting with a Warthin tumor-like pattern is needed.

Disclosure of conflict of interest

None.

Address correspondence to: Dr. Ji-Sup Yun, Department of Surgery, Kangbuk Samsung Hospital, School of Medicine, Sungkyunkwan University, 29 Saemunan-ro, Jongno-gu, Seoul 03181, Korea. Tel: +82-2-2001-1730; Fax: +82-2-2001-1883; E-mail: jisup.yun@samsung.com

References

[1] Apel RL, Asa SL and LiVolsi VA. Papillary Hurthle cell carcinoma with lymphocytic stroma. "Warthin-like tumor" of the thyroid. Am J Surg Pathol 1995; 19: 810-814.

[2] Yousef O, Dichard A and Bocklage T. Aspiration cytology features of the warthin tumor-like variant of papillary thyroid carcinoma. A report of two cases. Acta Cytol 1997; 41: 1361-1368.

[3] Kim SR and Sohn JH. Lymphocyte rich papillary oxyphilic carcinoma of thyroid. Korean J Cytopathol 1997; 8: 150-154.

[4] Vera-Sempere FJ, Prieto M and Camanas A. Warthin-like tumor of the thyroid: a papillary carcinoma with mitochondrion-rich cells and abundant lymphoid stroma. A case report. Pathol Res Pract 1998; 194: 341-347.
[5] Fadda G, Mule A, Zannoni GF, Vincenzoni C, Ardito G and Capelli A. Fine needle aspiration of a warthin-like thyroid tumor. Report of a case with differential diagnostic criteria vs. other lymphocyte-rich thyroid lesions. Acta Cytol 1998; 42: 998-1002.
[6] Vasei M, Kumar PV, Malekhoseini SA and Kadivar M. Papillary hurthle cell carcinoma (Warthin-like tumor) of the thyroid. Report of a case with fine needle aspiration findings. Acta Cytol 1998; 42: 1437-1440.
[7] Baloch ZW and LiVolsi VA. Fine-needle aspiration cytology of papillary hurthle cell carcinoma with lymphocytic stroma "Warthin-like tumor" of the thyroid. Endocr Pathol 1998; 9: 317-323.
[8] Tazawa K, Umemura S, Kajiwara H, Miyajima Y, Itoh H, Yasuda M and Osamura Y. Cytologic features of papillary carcinomas of the thyroid gland associated with chronic thyroiditis-4 cases report. J Jpn Soc Clin Cytol 1999; 38: 281-286.
[9] Imamura Y, Morishita T, Mori M, Maegawa M, Fukuda M and Konishi F. A case of Warthin-like tumor of the thyroid with Hashimoto's thyroiditis. J Jpn Society Clin Cytol 1999; 38: 563-569.
[10] Sarkady E, SÁpi Z, TÓth V and Kiss S. Warthin-like tumor of the thyroid-a case report. Pathol Oncol Res 1999; 5: 315-317.
[11] D'Antonio A, De Chiara A, Santoro M, Chiappetta G and Losito NS. Warthin-like tumour of the thyroid gland: RET/PTC expression indicates it is a variant of papillary carcinoma. Histopathology 2000; 36: 493-498.
[12] Baloch ZW and LiVolsi VA. Warthin-like papillary carcinoma of the thyroid. Arch Pathol Lab Med 2000; 124: 1192-1195.
[13] Ludvikova M, Ryska A, Korabecna M, Rydlova M and Michal M. Oncocytic papillary carcinoma with lymphoid stroma (Warthin-like tumour) of the thyroid: a distinct entity with favourable prognosis. Histopathology 2001; 39: 17-24.
[14] Urano M, Abe M, Kuroda M, Mizoguchi Y, Horibe Y, Kasahara M, Tanaka K, Sudo K and Hirasawa Y. Warthin-like tumor variant of papillary thyroid carcinoma: case report and literature review. Pathol Int 2001; 51: 707-712.
[15] Chang SH, Choi CS and Kim YS. Warthin-like tumor variant of papillary thyroid carcinoma. Korean J Pathol 2004; 38: 200-203.
[16] Lam KY, Lo CY and Wei WI. Warthin tumor-like variant of papillary thyroid carcinoma: a case with dedifferentiation (anaplastic changes) and aggressive biological behavior. Endocr Pathol 2005; 16: 83-89.
[17] Trovisco V, Soares P, Preto A, de Castro IV, Lima J, Castro P, Maximo V, Botelho T, Moreira S, Meireles AM, Magalhaes J, Abrosimov A, Cameselle-Teijeiro J and Sobrinho-Simoes M. Type and prevalence of BRAF mutations are closely associated with papillary thyroid carcinoma histotype and patients' age but not with tumour aggressiveness. Virchows Arch 2005; 446: 589-595.
[18] Kim HH, Myssiorek D, Heller KS, Zahurullah F and Bhuiya T. Warthin-like tumor of the thyroid gland: an uncommon variant of papillary thyroid cancer. Ear Nose Throat J 2006; 85: 56.
[19] Abrosimov A, Saenko V, Meirmanov S, Nakashima M, Rogounovitch T, Shkurko O, Lushnikov E, Mitsutake N, Namba H and Yamashita S. The cytoplasmic expression of MUC1 in papillary thyroid carcinoma of different histological variants and its correlation with cyclin D1 overexpression. Endocr Pathol 2007; 18: 68-75.
[20] Amico P, Lanzafame S, Li Destri G, Greco P, Caltabiano R, Vecchio GM and Magro G. Warthin tumor-like papillary thyroid carcinoma with a minor dedifferentiated component: report of a case with clinicopathologic considerations. Case Rep Med 2010; 2010: 495281.
[21] Panayiotides IG, Foukas PG, Meristoudis C, Zourla AP, Peros G and Karakitsos P. Simultaneous occurrence of Warthin-like papillary carcinoma and lymphoma of the mucosa associated lymphoid tissue in Hashimoto thyroiditis. J Clin Pathol 2010; 63: 662-663.
[22] Paker I, Kokenek TD, Yilmazer D, Seker GE and Alper M. Oncocytic variant of papillary thyroid carcinoma with lymphocytic stroma (Warthin-like variant): report of a case with fine needle aspiration cytology and review of the literature. Cytopathology 2012; 23: 408-410.
[23] Paliogiannis P, Attene F, Trogu F and Trignano M. Warthin-like papillary carcinoma of the thyroid gland: case report and review of the literature. Case Rep Oncol Med 2012; 2012: 689291.
[24] Ersen A, Durak MG, Canda T, Sevinc AI, Saydam S and Kocdor MA. Warthin-like papillary carcinoma of the thyroid: a case series and review of the literature. Turk Patoloji Derg 2013; 29: 150-155.
[25] Chong Y, Suh S, Kim TJ and Lee EJ. Fine needle aspiration cytology of Warthin-like papillary thyroid carcinoma: a brief case report. Korean J Pathol 2014; 48: 170-173.
[26] Yeo MK, Bae JS, Lee S, Kim MH, Lim DJ, Lee YS and Jung CK. The Warthin-like variant of papillary thyroid carcinoma: a comparison with classic type in the patients with coexisting hashimoto's thyroiditis. Int J Endocrinol 2015; 2015: 456027.
[27] Gonzalez-Colunga KJ, Loya-Solis A, Cecenas-Falcon LA, Barboza-Quintana O and Rodriguez-Gutierrez R. Warthin-like papillary thyroid carci-

noma associated with lymphadenopathy and Hashimoto's thyroiditis. Case Rep Endocrinol 2015; 2015: 251898.

[28] Han F, Zhang L, Zhang S, Zhou H and Yi X. Occult oncocytic papillary thyroid carcinoma with lymphoid stroma (Warthin-like tumor): report of a case with concomitant mutations of BRAF V600E and V600K. Int J Clin Exp Pathol 2015; 8: 5896-5901.

[29] Padma S, Sundaram PS and Arun BR. Unusual presentation of Warthin variant of papillary thyroid carcinoma with lymph nodal metastases in a patient of graves' disease. J Cancer Res Ther 2015; 11: 652.

[30] Jun HH, Kim SM, Hong SW, Lee YS, Chang HS and Park CS. Warthin-like variant of papillary thyroid carcinoma: single institution experience. ANZ J Surg 2016; 86: 492-494.

[31] Kim GR, Shin JH, Hahn SY, Ko EY and Oh YL. Ultrasonographic features and clinical characteristics of Warthin-like variant of papillary thyroid carcinoma. Endocr J 2016; 63: 329-335.