ORIGINAL ARTICLE

Papillary Thyroid Carcinoma

Prognostic Index for Survival Including the Histological Variety

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Background: Numerous prognostic factors have been studied for survival in patients with papillary thyroid carcinoma (PTC), although there are few multivariate studies that include the histological variety of PTC.

Hypothesis: There are prognostic factors that influence survival in a series of patients with PTC, including the histological variety, and a new prognostic index (PI) for survival can be formulated by accounting for these factors.

Design: A retrospective study.

Setting: A university hospital department of surgery.

Patients: Between January 1970 and December 1995, 200 patients undergoing surgery for PTC were observed (mean follow-up, 8 years).

Main Outcome Measures: A univariate analysis was done for survival rates using the Kaplan-Meier estimation method. The possible prognostic factors were evaluated using a multivariate analysis according to the Cox model. We formulated a PI and defined 3 risk groups (low, medium, and high) for mortality.

Results: Of the 200 patients, 175 (87.5%) are still alive. Of the 25 deaths, 19 (9.5%) were due to the tumor. The survival was 97.5% at 1 year, 92.8% at 5, 89.5% at 10, and 83.9% at 15 and 20 years. The prognostic factors obtained after the multivariate analysis were age, tumor size, extrathyroid spread, and histological variant of the PTC. The PI is calculated as follows: PI = (2 × size) + (6 × spread) + (2 × variant) + (3 × age). As for the risk groups, the low-risk group showed a mortality of 0%; the medium-risk group, 17.1%; and the high-risk group, 76.5%.

Conclusions: The histological variety of PTC has prognostic value for survival in patients with PTC. As risk factors for PTC mortality, we consider an age of 50 years or older, a tumor larger than 4 cm, the existence of extrathyroid spread, and a certain histological subtype of PTC. With these risk factors, it is possible to formulate a PI and classify patients into low-, medium-, and high-risk groups for mortality.

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PAPILLARY thyroid carcinoma (PTC) is the most common variety of thyroid cancer (70%-80% of cases) and the most common endocrine neoplasia.

Classically, PTC has been classified as a well-differentiated thyroid cancer, together with follicular thyroid cancer, because of its good prognosis and low mortality rate.[1-3] However, there are a few patients with this neoplasia who present with an apparently paradoxical evolutive behavior; this makes us think there may be another series of factors, besides those already known and included in the AGES (age, grade, extension, size) or MACIS (metastases, age, complete surgery, invasion, size) scoring systems of the Mayo Clinic, Rochester, Minn, the EORTC (European Organization Research Treatment Cancer) prognostic index (PI), the AMES (age, metastases, extension, size) system, the pTNM classification, and others,[4-9] that influence prognosis in these patients.

Furthermore, in recent years a series of anatomicopathological variants of papillary carcinoma have been reported; these appear to determine anatomicoclinical differences and probably determine a different prognosis from that of classic papillary carcinoma. These histological varieties of PTC have not been included in the previously mentioned PIs or scores. This study analyzes the prognostic factors in our series to determine which of them affect survival, including PTC histological variety, and tries to define a new PI to predict the biological behavior for the survival of patients with this neoplasia.

RESULTS

The mean age of the patients was 41.5 years (range, 10-84 years); 142 (71.0%) were

PATIENTS AND METHODS

Between January 1970 and December 1995, 212 patients with PTC underwent surgery in the General Surgery Unit, Virgen de la Arrixaca University Hospital, Murcia, Spain; of these patients, 200 are the object of this study and 12 were excluded due to an incomplete follow-up. Patient follow-up averaged 8 years (range, 0.4-25.0 years), with 2 years being the minimum follow-up of the patients still alive. The mean patient age was 41.5 years (range, 10-84 years); 80.0% were females.

Before surgery, a detailed medical history was obtained from all the patients. A careful physical examination of the neck; an analytic and hormone study, including determination of thyroid hormone, thyroglobulin, and calcitonin levels; simple chest radiography; cervical ultrasonography; and fine-needle aspiration of the thyroid nodule or cervical adenopathy revealed by the patient at the time of consultation were also performed before surgery. Surgery was indicated when a papillary carcinoma was suspected after cytologic diagnosis by fine-needle aspiration of a papillary carcinoma or follicular proliferation (suspicion of a malignant neoplasm). After surgery, most patients were administered an ablative dose of iodine 131 and treatment was implemented with thyroxine at doses to suppress thyrotropin. Iodine 131 was not administered to patients who were the earliest cases in the series or to patients who underwent unilateral lobectomy in whom a papillary microcarcinoma without lymph node metastasis was encountered during the histological study. For their follow-up, all the patients underwent regular checkups in the outpatient department. Patient follow-up included a clinical examination; determination of the serum levels of thyroxine, thyrotropin, and thyroglobulin (considering thyroglobulin level <2 µg/L as normal in patients who underwent total thyroidectomy); simple chest radiography; scintigraphy screening with ^{131}I; and cervical ultrasonography.

In this retrospective study, we analyzed the following:

1. Patient age at the time of PTC diagnosis, dividing the patients into 2 groups (<50 and ≥ 50 years).
2. Sex.
3. Reason for consultation.
4. Existence of lymph node or distant metastasis at the time of diagnosis.
5. Surgical technique performed: total thyroidectomy, bilateral subtotal thyroidectomy, or lobectomy. The association of ipsilateral functional lymph node emptying of the tumor if there was lymph node metastasis during the surgical intervention was confirmed by preoperative biopsy.
6. Histopathological study, including the following: (1) tumor size (≤ 1 cm [or microcarcinomas], 1-4 cm, and >4 cm), according to pTNM classification adjusted for age; (2) total capsule, the existence of a well-defined fibrous wall totally separating the tumor cells from adjacent tissues; (3) extrathyroid spread, infiltration into fat, muscles, or other tissues adjacent to the thyroid (trachea, larynx, cervical vessels, recurrent laryngeal nerve, or esophagus); (4) multifocality, the existence of 3 or more independent tumoral foci; and (5) vascular involvement, the presence of tumor cells in the lumen or wall of the vessels, existence of lymph node metastasis confirmed by histological features, or histological variety of the PTC as found by the pathologist (J.S.). The morphologic criteria for diagnosing each of the varieties of PTC have been described by Carcangiu et al[10] and Chan.[11]
7. Staging according to the pTNM classification adjusted for age.[8]
8. Follow-up data, including overall mortality, tumor-related mortality, and mortality due to other causes and locoregional recurrence of the disease or development of distant metastasis.

We calculated the survival rates and disease-free interval at 1, 5, 10, 15, and 20 years after surgical treatment.

A univariate analysis was performed for survival using the Kaplan-Meier estimation method for the following variables: age, sex, surgical technique, distant metastasis at the time of diagnosis, tumor size, presence or absence of a capsule, intrathyroid or extrathyroid invasion, vascular invasion, multicentricity, metastatic adenopathies, and PTC histological variety. The actuarial survival curves of each of the groups were compared using the log-rank test.

Subsequently, a multivariate analysis was performed with the same variables as previously described with a Cox proportional risk regression model using a process of backward-step selection and, in the initial model, using the variables significantly related to survival. The significant risk factors are given, with the risk ratio (95% confidence interval) of each category.

As far as the variable "histological variety of PTC" is concerned, we defined the categories depending on the results obtained for survival after the univariate analysis: (1) well-differentiated PTC, follicular variant PTC, and diffuse sclerosis variant PTC; (2) tall-cell variant PTC and solid variant PTC; and (3) poorly differentiated variant PTC.

Last, we obtained a PI by scoring each category of each prognostic factor and using the rounded-off regression coefficients of the exponential part of the Cox model obtained. We present 3 groups of risk scoring, the first cut-off point being the third quartile, ie, approximately 75% of the series in which survival is zero. The actuarial survival curves are presented for each of the risk groups.

younger than 50 years. Of the 200 patients, 80.0% were females, 79.0% were admitted for a previous cervical tumor of thyroid origin (a solitary thyroid nodule, a diffuse goiter, or a multinodular goiter), 16.5% presented with compressive symptoms at the time of diagnosis, and 5.5% presented with clinical symptoms of hyperparathyroidism. Forty (20.0%) patients presented with palpable laterocervical adenopathies; in 9 (4.5%) patients, there was already distant metastasis (5 in the lung, 2 in the bone, 1 in the brain, and 1 in the amygdala) at the time of consultation.

As far as surgical treatment is concerned, bilateral total thyroidectomy was performed in 143 patients (71.5%); bilateral subtotal thyroidectomy in 28 (14.0%); and unilateral lobectomy in 29 (14.5%). Ipsilateral functional lymph node emptying was associated initially in 65 patients (32.5%).

In the histopathological study, we found 59 tumors (29.5%) smaller than 1 cm (also called microcarcinomas), 103 tumors (51.5%) between 1 and 4 cm, and 38 tumors (19.0%) larger than 4 cm. The tumor was encapsulated in 29 cases (14.5%); there was extrathyroid

Table 1. Clinical and Histological Features of the Groups of Patients With and Without Mortality*

Features	Tumor-Related Mortality (n = 19)	No Mortality (n = 175)	Mortality for Other Causes (n = 6)	P
Age, y				
<50 (n = 142)	3 (2.1)	137 (96.5)	2 (1.4)	<.001
≥50 (n = 58)	16 (27.6)	38 (65.5)	4 (6.9)	
Sex				
Female (n = 160)	10 (6.2)	146 (91.2)	4 (2.5)	.006
Male (n = 40)	9 (22.5)	29 (72.5)	2 (5.0)	
Surgical technique				
TT (n = 143)	13 (9.1)	126 (88.1)	4 (2.8)	.24
BSTT (n = 28)	5 (17.9)	23 (82.1)	0	
Lobectomy (n = 29)	1 (3.4)	26 (89.7)	2 (6.9)	
Initial distant metastasis				
Yes (n = 9)	8 (88.9)	1 (11.1)	0	<.001
No (n = 191)	11 (5.8)	174 (91.1)	6 (3.1)	
Tumor size, cm				
≤1 (n = 59)	1 (1.7)	57 (96.6)	1 (1.7)	<.001
1-4 (n = 103)	7 (6.8)	93 (90.3)	3 (2.9)	
>4 (n = 38)	11 (29.0)	25 (65.8)	2 (5.2)	
Capsule				
No (n = 171)	19 (11.1)	146 (85.4)	6 (3.5)	.04
Yes (n = 29)	0	29 (100)	0	
Spread				
Intrathyroid (n = 153)	1 (0.7)	148 (96.7)	4 (2.6)	<.001
Extrathyroid (n = 47)	18 (38.3)	27 (57.5)	2 (4.2)	
Vascular involvement				
No (n = 185)	12 (6.5)	167 (90.3)	6 (3.2)	<.001
Yes (n = 15)	7 (46.7)	8 (53.3)	0	
Multicentricity				
No (n = 126)	9 (7.1)	113 (89.7)	4 (3.2)	.09
Yes (n = 74)	10 (13.5)	62 (83.8)	2 (2.7)	
Adenopathies				
No (n = 135)	6 (4.4)	128 (94.8)	1 (0.8)	<.001
Yes (n = 65)	13 (20.0)	47 (72.3)	5 (7.7)	
Variant				
WDPC (n = 132)	5 (3.8)	122 (92.4)	5 (3.8)	<.001
FPC (n = 45)	2 (4.4)	42 (93.3)	1 (2.2)	
DSPC (n = 5)	0	5 (100)	0	
SPC (n = 3)	2 (66.7)	1 (33.3)	0	
TCPC (n = 9)	5 (55.6)	4 (44.4)	0	
PDPC (n = 6)	5 (83.3)	1 (16.7)	0	

*Data are given as the number (percentage) across the row. Percentages may not total 100 because of rounding. TT indicates total thyroidectomy; BSTT, bilateral subtotal thyroidectomy; WDPC, well-differentiated papillary thyroid carcinoma (PTC); FPC, follicular variant PTC; DSPC, diffuse sclerosis variant PTC; SPC, solid variant PTC; TCPC, tall-cell variant PTC; and PDPC, poorly differentiated variant PTC.

invasion in 47 (23.5%), vascular invasion in 15 (7.5%), multifocality or multicentricity of the tumor in 74 (37.0%), and metastatic adenopathies at the time of diagnosis in 65 (32.5%). The PTC histological subtype encountered by the pathologist (J.S.) was well-differentiated or classic PTC in 132 cases (66.0%), follicular variant PTC in 45 (22.5%), tall-cell variant PTC in 9 (4.5%), poorly differentiated PTC in 6 (3.0%), diffuse sclerosis variant PTC in 5 (2.5%), and solid variant PTC in the remaining 3 (1.5%).

After the distribution of patients into stages according to pTNM classification adjusted for age, 131 patients (65.5%) corresponded to stage I, 24 (12.0%) to stage II, 36 (18.0%) to stage III, and 9 (4.5%) to stage IV.

Table 2. Results of the Multivariate Analysis for Survival After Applying the Cox Model*

Variable	Score	Regression Coefficient (β)	SE	Odds Ratio	P
Age, y					
<50	1	0	. . .	1	.02
≥50	2	1.58	0.66	4.83	
Tumor size, cm					
1-4	1	0	. . .	1	.05
>4	2	1.02	0.53	2.78	
Spread					
Intrathyroid	1	0	. . .	1	.008
Extrathyroid	2	2.86	1.08	17.42	
Variant					
WDPC, FPC, or DSPC	1	0	. . .	1	. . .
SPC or TCPC	2	1.13	0.38	3.10	.002
PDPC	3	2.26	. . .	9.56	<.001

*The variables with prognostic relevance are indicated with their regression coefficient, relative risk, and statistical significance. WDPC indicates well-differentiated papillary thyroid carcinoma (PTC); FPC, follicular variant PTC; DSPC, diffuse sclerosis variant PTC; SPC, solid variant PTC; TCPC, tall-cell variant PTC; PDPC, poorly differentiated variant PTC; and ellipses, data not applicable.

Twenty-five patients (12.5%) died during follow-up, 19 (9.5%) as a result of tumors and 6 (3.0%) for other causes, with overall survival being 87.5%. One hundred forty six (73%) patients are alive and disease free. The survival in our series at 1, 5, 10, 15, and 20 years was 97.5%, 92.8%, 89.5%, 83.9% and 83.9%, respectively.

Of the 200 patients, 54 (27.0%) presented with locoregional recurrence or distant metastasis of the disease. Forty-three (80%) patients who presented with recurrence did so within the first 5 years of follow-up, with 2.8 years being the mean time at which recurrence occurred. Of the 54 patients who presented with recurrence of the disease during follow-up, 37 (68%) were for local recurrence, 36 (67%) were for lymph node recurrence, and 10 (18%) were for distant metastasis (6 in the lung, 2 in the bone, and 2 in the central nervous system). The disease-free interval for the 200 patients at 1, 5, 10, 15, and 20 years was 88%, 77%, 68.9%, 61.9%, and 83.9%, respectively.

In the univariate analysis for survival, the variables showing statistical significance were age, sex, distant metastasis, tumor size, capsule, extrathyroid spread, vascular invasion, metastatic adenopathies, and histological variant of PTC. Surgical technique and multicentricity showed no statistical significance. **Table 1** shows the results of the univariate analysis for each of the variables.

After performing the multivariate analysis for survival using the Cox model (**Table 2**), the variables with prognostic importance were age (longer survival in patients <50 years), tumor size (longer survival in patients with tumors of <4 cm), extrathyroid spread (caused greater mortality), and histological variant of the PTC (greater mortality in patients with the solid, tall-cell, and poorly differentiated variant PTCs). **Figure 1** shows the actuarial survival curves of the variables with statistical significance obtained after the multivariate analysis (comparison of curves using the log-rank test).

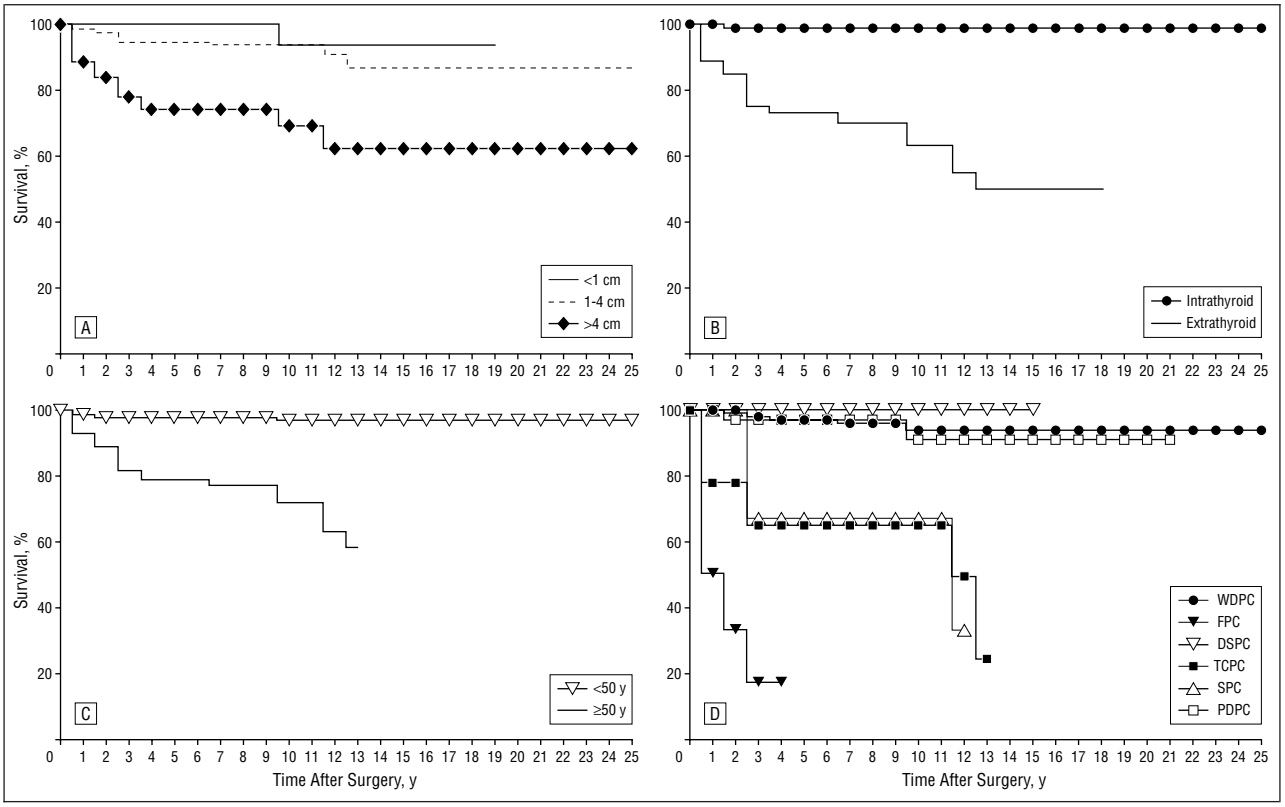

Figure 1. *Actuarial survival curves of the variables with statistical significance (P<.001 in all variables, log-rank test) obtained after the multivariate analysis. A, Tumor size. B, Spread. C, Age. D, Histological variant. WDPC indicates well-differentiated papillary thyroid carcinoma (PTC); FPC, follicular variant PTC; DSPC, diffuse sclerosis variant PTC; TCPC, tall-cell variant PTC; SPC, solid variant PTC; and PDPC, poorly differentiated variant PTC.*

Based on these results, we obtained a PI using the rounded-off regression coefficients of the Cox model and scoring each of the categories of each prognostic factor. The PI is calculated as follows: PI = (3 × age) + (2 × size) + (6 × spread) + (2 × HV variant), where HV indicates histologic variant).

The mean ± SD score was 16.0 ± 2.9 points, with a minimum of 13 (100 cases) and a maximum of 28 (4 cases). The patients scoring below 18 points (n = 148) were classified as low risk, with zero mortality; those scoring from 18 to 22 points (n = 35) were considered medium risk, with a 17.1% tumor-related mortality; and those scoring higher than 22 points (n = 17) were considered high risk, with a 76.5% disease-related mortality. The survival at 1, 5, 10, 15, and 20 years in each of the risk groups is shown in **Table 3**. **Figure 2** gives the actuarial survival curves of each of the risk groups.

COMMENT

Various different multivariate analyses have been performed to discover which of the more important prognostic factors influence mortality in patients with PTC. These studies have occasionally yielded disparate and controversial results. From these multivariate analyses, a series of PIs or scores[4-9] have been designed to attempt to define risk groups that would have a greater or lesser probability of disease-related death.

De Groot et al[12] in a 1994 study of 269 patients with PTC applied as many as 5 different PIs. In each of the PIs performed, there were patients who belonged to the low-risk group and subsequently died of cancer. This suggests that none of these scoring systems guarantees individual decisions for patients at the time of surgery. Another of the drawbacks of these PIs is that they do not distinguish between the different varieties of PTC, which in our series showed different biological behaviors.

After the multivariate analysis, the variables most influencing mortality and survival in our patients were age, tumor size, extrathyroid spread, and histological subtype of the PTC.

An age of 50 years and older in our series meant a poorer prognosis, with lower rates of survival than among the patients younger than 50 years. For most researchers, old age at the time of diagnosis is a poor prognostic factor, representing a greater mortality. The pTNM classification[8] divides patients into 2 groups, younger than 45 years and 45 years and older, the latter having a poorer prognosis. For Carcangiu et al,[10] the line is drawn at 40 years, whereas according to Mazaferri,[13] an increased mortality occurs from 60 years onward. Likewise for Hay,[4,5] Cady,[7] and Akslen[9] and their colleagues, age is an independent prognostic factor and included among the prognostic factors they propose to predict survival (AGES, MACIS, AMES, and SAG [size, age, grade]).

As for tumor size, the tumors with the worst prognosis in our series were larger than 4 cm. There are also several studies that have proposed tumor size as a prognostic factor in patients with PTC. Carcangiu[10] reports in his series that microcarcinomas carry a zero mortality and a longer disease-free survival than the rest of the tumors. These findings are similar to those of a series of 535 microcarcinomas at the Mayo Clinic,[14] in which the overall

Table 3. Survival of Each of the Risk Groups at 1, 5, 10, 15, and 20 Years*

Year	Risk Group		
	Low	Medium	High
1	100	97	76
5	100	91	39
10	100	77	39
15	100	77	. . .
20	100	77	. . .

*Data are given as percentages. Ellipses indicate data not available.

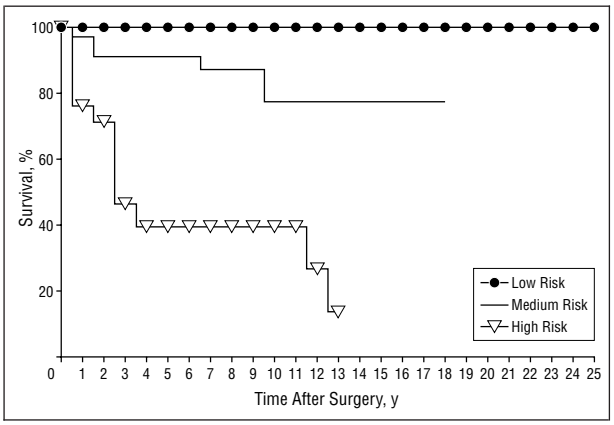

Figure 2. *Actuarial survival curves of each of the risk groups obtained after performing the prognostic index (P<.001, log-rank test).*

mortality of the series is 0.4% and recurrence is 6%. Hay and colleagues include tumor size in the scoring systems proposed by the Mayo Clinic (AGES[4] and MACIS[5]), with the risk of death increasing steadily with increased tumor size. Likewise for Cady and Rossi,[7] tumor size is a key prognostic factor and included in the AMES scoring system. According to Mazaferri,[13] the size of the primary lesion greatly influences disease recurrence and survival. In the same way, one of the prognostic factors included in the pTNM system[8] of classification by stages is tumor size, with larger tumors proving to have lower rates of survival.

The existence of extrathyroid spread was one of the variables that showed most relevance as a prognostic risk factor for mortality. We had a specific tumor-related mortality of 38% in tumors with extrathyroid spread and 0.65% in those without. These findings can be superimposed on those reported by other researchers. Carcangiu[10] reports a mortality in tumors with extrathyroid invasion some 10 times higher than that found in primary tumors that are strictly intrathyroid. Mazaferri[13] reports higher mortality rates (5.9% vs 1.4%) in tumors with local invasion than in those without. Andersen et al,[15] in a study of 1012 patients with differentiated thyroid carcinoma, show that tumors with extrathyroid spread have a 77% specific disease-related mortality, a considerably higher figure than for intrathyroid tumors. For Hay,[4,5] Cady,[7] and Pasieka[16] and their colleagues, the presence of extrathyroid spread represents an important prognostic risk factor for survival in these patients, and they include it in the scoring systems they propose (AGES, MACIS, AMES, and DAMES [DNA, age, metastases, extension, size]).

Histological variety of the PTC was also a key prognostic factor for survival. Like Carcangiu,[10] Chen,[17] Albores-Saavedra,[18] Tielens,[19] and Rosai[20] and their colleagues, we found no prognostic differences between the follicular variety and the well-differentiated form.

As for the diffuse sclerosis variety, we found no significant differences in mortality when compared with the classic variety, as mortality in this group of patients was zero. Researchers such as Rosai[20] and Carcangiu and Bianchi[21] find a shorter disease-free interval and an increased mortality, whereas others[22-24] do not find any long-term adverse effects on survival, as occurs with our patients.

The varieties showing the worst prognosis were the tall-cell variety, the poorly differentiated variety, and the solid variety. In these 3 varieties, we found a high incidence of extrathyroid spread, local and lymph node recurrences of the disease, distant metastasis, and specific tumor-related mortality, with statistically significant differences compared with the classic or well-differentiated variety.

The tall-cell variety of PTC is characterized, according to most researchers such as Johnson,[25] Moreno,[26] Ostrowski,[27] and Terry[28] and their colleagues, as having an aggressive behavior, with high rates of mortality and recurrence of the disease. The poorly differentiated PTC variety reported by researchers such as Carcangiu et al[29] presents, as in our cases, an extremely aggressive behavior with high rates of local and distant metastasis, recurrences, and mortality. The solid variety of PTC is a rather controversial histological subtype; there are researchers, such as Carcangiu,[10] Rosai,[20] Molberg,[30] and Yamasita[31] and their colleagues, for whom this variety shows no prognostic differences from the classic or well-differentiated variety, whereas for Mizukami et al[32] and for us this histological variety represents a poor prognostic factor for mortality.

All the most important scoring systems reported so far (AGES and MACIS of the Mayo Clinic, AMES and DAMES, pTNM, and SAG)[4,5,7-9,16] include age, size, and extrathyroid spread (except SAG, which does not include extrathyroid spread) as significant prognostic factors for mortality, as we do. However, the subtype or histological variant of PTC is not included in any of the scoring systems described so far. Only the AGES system and SAG include the histological grade of the tumor, but not histological subtype, as a prognostic factor.

There are other prognostic factors included in other multivariate studies, but they had no prognostic relevance in our study. Among these are the surgical treatment given, the presence of distant metastasis at the time of initial treatment, and sex. According to several studies,[10,13,33,34] complete surgery on the thyroid gland implies lower rates of recurrence than incomplete surgery but does not influence mortality. However, Hay[5] and McConahey[35] and their colleagues report significantly higher survival rates in their patients who undergo complete initial surgery than in the patients who undergo incomplete initial surgery and include this variable in the MACIS scoring system. Despite our results, we advocate a total thyroidectomy for management of PTC as it allows better control in the follow-up of thyroglobulin levels, allows better isotopic screening with ^{131}I, and may prevent a possible multifocality of the tumor, which in our series was 37.0% of the cases. As for distant metastasis

at the time of diagnosis, most researchers[10,13,31,35-38] believe it has a high predictive value for mortality in these patients. In our multivariate analysis, the presence of distant metastasis was not statistically significant, possibly because of the few patients (n = 9) who presented with it, although it did have statistical significance in the univariate analysis. Other scoring systems, such as AGES, AMES, DAMES, and MACIS, do include distant metastasis among the significant prognostic factors. Various researchers[6,9,13,39] consider male sex to be a poor prognostic factor in patients with PTC. In our univariate analysis, masculine sex showed a higher mortality rate than feminine sex, although it was not statistically significant in the multivariate analysis. Of the scoring systems reported, only the SAG system proposed by Akslen[9] includes sex as a key prognostic factor for survival.

As previously mentioned, the AGES and SAG scoring systems include histological grade among their prognostic factors, based on nuclear atypia, tumoral necrosis, and vascular invasion. In our study, instead of histological grade we assessed subtype or histological variant of the PTC as a prognostic factor. Considering it was a variable with prognostic relevance for mortality in our patients, we believe it should be included in the PIs or scores performed for PTC.

After performing the multivariate analysis, we calculated a new PI based on the significant prognostic factors obtained (age, size, spread, and PTC variant), scoring each of the categories. The score obtained in the PI enabled us to define 3 risk groups (low, medium, and high) for mortality. In the low-risk group, tumor-related mortality is zero, with a survival of 100% of patients, whereas in the medium-risk group it is 17.1%, and in the high-risk group it is 76.5%. Other PIs also establish risk groups according to the score obtained. The AGES and MACIS systems establish 4 risk groups, with a 20-year mortality of 0.9%, 11.3%, 44.4%, and 76.5% for each group. The AMES system only proposes 2 risk groups (low and high), with a mortality of 1.8% and 46%. SAG establishes 3 risk groups, with a 15-year mortality of 1.7%, 12%, and 61%. These risk groups and mortality rates established by other study groups can be compared with the results obtained in our series.

In conclusion, we regard the following variables as high risk for mortality due to PTC: age of 50 years or older; tumors larger than 4 cm; extrathyroid spread; and association with certain histological subtypes of PTC, such as the tall-cell, the solid, and the poorly differentiated varieties. Last, the PTC histological subtype must be taken into account when assessing the prognosis of a patient with PTC.

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