

original article

Thyroid carcinoma in the United Arab Emirates: perspectives and experience of a tertiary care hospital

Nabil Al-Zaher,^a Suhail Al-Salam,^b Hassan El Teraifi^cFrom the ^aDepartment of Otolaryngology/Head and Neck Surgery and Communication Sciences, King Faisal Specialist Hospital and Research Center, Riyadh, Saudi Arabia; ^bUniversity of the United Arab Emirates and ^cTawam Hospital, United Arab Emirates

Correspondence and reprint requests: Dr. Nabil Al-Zaher · Department of Otolaryngology/Head and Neck Surgery and Communication Sciences, King Faisal Specialist Hospital and Research Center · MBC 47, PO Box 3354, Riyadh 11211, Saudi Arabia · nalzaher@hotmail.com · Accepted for publication November 2007

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BACKGROUND: Although the distribution of thyroid carcinoma in the Arab Gulf States has been described, no previous study has examined the characteristic clinicopathologic features of thyroid carcinoma cases in the United Arab Emirates.

METHODS: The medical records of 135 patients with thyroid carcinoma diagnosed over a 15-year period (1991-2005) at Tawam Hospital, the national referral oncology center in the UAE, were retrospectively studied and the cases classified according to the histologic classification of the World Health Organization (WHO).

RESULTS: Seventy-eight patients (58%) were diagnosed before the age of 45 years with an overall peak incidence in the fourth and fifth decades. The female to male ratio was 2.4:1. Eighty-four percent had papillary thyroid carcinoma (PTC), while follicular thyroid carcinoma (FTC), anaplastic thyroid carcinoma and medullary carcinoma comprised 14%, 1.4% and 0.6%, respectively. The conventional classical variant of papillary carcinoma was the most common type. Three-quarters of the papillary carcinomas presented as multinodular goiter, while one-fifth presented as a solitary thyroid nodule. Minimal invasive follicular carcinoma was the most common variant of follicular carcinoma.

CONCLUSION: Thyroid carcinoma in the United Arab Emirates seems to be more common among females and female gender may be a risk factor. Age <45 years can be considered an important prognostic factor as well as a possible risk factor. PTC predominates the histologic pattern of thyroid carcinoma, which is usually associated with an iodide-sufficient area.

Although several reports examining the distribution of thyroid carcinoma (TC) in the Middle East, in general, and in the Arab Gulf states, in particular, have been documented,¹⁻⁴ no study has previously reported on the characteristic clinicopathologic features of thyroid carcinoma in the United Arab Emirates (UAE). Thyroid cancer is the most common endocrine malignancy, and clinical thyroid cancer accounts for 1% to 2% of all cancers.⁵ Epidemiological studies have reported a progressive increase in the overall incidence over the past 20 years.⁵ TC may produce a wide range of clinical presentations from highly differentiated carcinoma with a good prognosis to undifferentiated carcinoma that occurs mainly in older people and has a poor prognosis.⁶ Different factors contribute to this variability, such as histologic pattern, tumor size, age at diagnosis and gender.⁶ The incidence of thyroid

cancer is subject to ethnic and geographical variation. The highest incidence rates are reported in areas of high iodine intake; however, there is no general consensus on these findings. In fact, the overall incidence of differentiated TC is not considered to be influenced by iodine intake in a population, whereas the distribution of the types of thyroid carcinoma seems to be related to the intake of iodine, with fewer of the more aggressive follicular and anaplastic thyroid carcinomas and more of the papillary thyroid carcinomas (PTCs) being observed in iodine-rich areas.⁵ In the UAE, TC is the sixth most common cancer among nationals and the second among females.⁷ The present clinicopathologic study analyzes the distribution of thyroid carcinoma in a large number of patients living in the UAE, including nationals and expatriates who were referred to Tawam hospital, the national referral oncology center in the UAE, and com-

compares the results with others reported from the Arab Gulf States and other Asian and Western countries.

MATERIALS AND METHODS

The 135 cases of thyroid carcinoma diagnosed in the pathology department at Tawam Hospital during a 15-year period (1991-2005) were reviewed. Tawam Hospital, located in Al-Ain, is the main oncology center in UAE. Clinical information from the histopathologic records relating to sex, age, ethnicity, location of tumor at presentation, size of tumor, and type of operation was reviewed. The tumor size was classified as T1 when less than 2 cm in diameter, T2 when 2-4 cm in diameter, T3 when more than 4 cm in diameter without extrathyroid local extension, and T4 when there was extrathyroid local extension.

Five-micrometer sections were obtained from paraffin blocks and stained with hematoxylin and eosin. Immunohistochemical stains using the streptavidin-biotin immunoperoxidase method for thyroglobulin, epithelial membrane antigen, vimentin, Bcl2, CD45, cytokeratin, chromogranin, and calcitonin were used on specific occasions in confirming the diagnosis of different histological types of primary and metastatic TC. All thyroid carcinomas were classified according to the WHO classification.⁶ Each case was examined independently by at least two pathologists participating in the study. To preclude any discrepancies, the opinion of other experts in the field was sought until consensus was reached.

Student's t-test was used to compare continuous variables. Quantitative variables were analyzed with the chi-square test and correlations of ordinal variables using the Spearman rank correlation coefficient. A P value <0.05 was considered significant. Where appropriate numerical data are presented as the mean±SD.

RESULTS

One hundred and thirty patients had TC. Seventy-eight patients (58%) were younger than 45 years of age at diagnosis. The overall mean age was 42±14 years, the median 40 years, the range 8-78 years, and the overall peak incidence was in the fourth and fifth decades. The mean age for males was 43.3±12 years, the median 44 years, the range 8-68 years, and the peak incidence was in the fifth decade. The mean age for females was 40±13.2 years, the median 37 years, the range 13-78 years, and the peak incidence was in the fourth decade. There was a female preponderance with an overall female: male ratio 2.4:1. There was a significant difference in gender ratio between the native (11.5:1) and the expatriate patients (1.4:1) (P<0.001). The overall age and

gender distribution is shown in Table 1.

Papillary thyroid carcinoma (PTC) was the most common type comprising 84%, followed by follicular thyroid carcinoma (FTC), anaplastic thyroid carcinoma (ATC) and medullary thyroid carcinoma (MTC) comprising 14%, 1.4%, and 0.6% respectively (Table 2). There was no significant difference in the frequency of the histological types between UAE nationals and expatriates (P≥1.000). One hundred thirteen cases (84%) had papillary carcinoma. The overall mean age was 40.2±13.3 years, the median 40 years, and the range 8-78 years. Sixty-seven patients (59%) had the disease before the age of 45 years, and the peak incidence was in the fifth decade.

The mean age for males was 43.4±12.5 years, the median 45 years, the range 8-73 years, and the peak incidence was in the fifth decade. The mean age for females was 41±14.8 years, the median 37 years, the range 16-78 years, and the peak incidence was in the third decade. A female preponderance was found in all the decades with a female to male ratio of 2.3:1.

Forty-three cases among the UAE nationals had papillary carcinoma. The overall mean age was 35.7±12.1 years, the median 34 years, and the range 17-71 years. Thirty-eight patients (88%) had the disease before the age of 45 years, and the peak incidence was in the 3rd decade. The mean age for males was 5.5±15.3 years, the median 38 years, the range 17-49 years, and the peak incidence was in the fifth decade. The mean age for females was 35.7±12.1 years, the median 34.5 years, the range 20-71 years, and the peak incidence was in the third decade. A female preponderance was found in all the decades with an overall female to male ratio 10:1.

Table 1. The overall age and gender distribution of thyroid carcinoma in Tawam Hospital UAE (1991-2005).

Years	UAE Nationals			UAE Expatriates			Total		
	M	F	T	M	F	T	M	F	T
0-9	0	0	0	1	0	1	1	0	1
10-19	1	2	3	0	3	3	1	5	6
20-29	1	17	18	1	4	5	2	21	23
30-39	0	11	10	8	14	21	8	25	33
40-49	2	11	13	11	9	20	13	20	33
50-59	0	4	4	9	13	21	9	17	26
60-69	0	0	0	5	3	6	5	3	8
70-79	0	1	1	1	3	4	1	4	5
Total	4	46	50	36	49	85	40	95	135

Table 2. The frequency of thyroid carcinoma at Tawam Hospital, United Arab Emirates (1991-2005).

Histological type	M	F	F : M	T	%
Papillary carcinoma	34	89	2.6:1	113	84
Follicular carcinoma	5	14	2.8:1	19	14
Anaplastic carcinoma	0	2		2	1.4
Medullary carcinoma	1	0		1	0.6
Total	40	95	2.4:1	135	100

Table 3. The pattern of clinical presentation in patients with papillary thyroid carcinomas.

Presenting feature	Nationals		Expatriates		Total	
	No	%	No	%	No	%
Solitary thyroid Nodule	10	23	17	24	27	24
Multinodular goiter	31	72	47	67	78	69
Cervical Lymph node	2	5	6	9	8	7
Total	43	100	70	100	113	100

Table 4. The histological pattern of papillary carcinoma in Tawam Hospital (1991-2005).

Histological pattern	Nationals				Expatriates				Total			
	M	F	T	%	M	F	T	%	M	F	T	%
Classical variant	2	24	26	60	22	25	47	67	24	49	73	65
Mixed classical and follicular variant	1	7	8	19	5	9	14	20	6	16	22	19
Follicular variant	1	4	5	11	2	4	6	8	3	8	11	9
Encapsulated variant	0	2	2	5	1	2	3	5	1	4	5	5
Tall cell variant	0	2	2	5	0	0	0	0	0	2	2	2
Total	4	39	43	100	30	40	70	100	34	79	113	100

Seventy cases of the UAE expatriates had papillary carcinoma. The overall mean age was 43±13 years, the median 44 years, and the range 8-78 years. Thirty-eight patients (54%) had the disease before the age of 45 years, and the peak incidence was in the fifth decade. The mean age for males was 44.5±11.8 years, the median 45 years, the range 8-73 years, and the peak incidence was in the fifth decade. The mean age for females was 42±14 years, the median 41 years, the range 16-78 years, and the peak incidence were in the fourth decade. A female preponderance was noticed in most of the decades with female to male ratio of 1.3:1. There was a significant difference in the mean age between the UAE nationals and expatriates ($P<0.01$). There was a significant difference in gender ratio (F: M) between the native

(10:1) and the expatriate patients (1.3:1) ($P<0.002$)

The frequency of the presenting signs in patients with PTC is shown in Table 3. There were no significant differences in the frequency of the first presenting sign between UAE nationals and expatriates ($P\geq 1.000$). The right thyroid lobe was affected more than the left thyroid lobe and the isthmus by PTC. There were no significant differences in the frequency of the affected lobes between UAE nationals and expatriates ($P\geq 1.000$).

The tumor size in about 80% of the cases were less than 4 cm in diameter and half of these were less than 2 cm in diameter. There was a significant difference in the frequency of tumor size categories between UAE nationals and expatriates ($P<0.003$). The overall distribution of cases according to tumor size is shown in Figure

Table 5. The overall age and gender distribution of 18 cases of follicular thyroid carcinoma at Tawam Hospital (1991-2005).

Years	Native			Resident			Total		
	M	F	T	M	F	T	M	F	T
0-9	0	0	0	0	0	0	0	0	0
10-19	0	2	2	0	0	0	0	2	2
20-29	0	1	1	0	0	0	0	1	1
30-39	0	1	1	1	2	3	1	3	4
40-49	0	2	2	0	2	2	0	4	4
50-59	0	0	0	1	3	4	1	3	4
60-69	0	0	0	3	0	3	3	0	3
70-79	0	0	0	0	1	1	0	1	1
Total	0	6	6	5	8	13	5	14	19

1. The relative frequencies of the histological patterns of papillary carcinoma are shown in Table 4. There was no significant difference in the frequency of the histological patterns between UAE nationals and expatriates ($P \geq 1.000$).

The cervical lymph nodes were involved in 40% of the cases. In 35% of the cases there was ipsilateral involvement while bilateral involvement was seen in 5% of the cases only. There was no significant difference in the frequency of cervical lymph node involvement between UAE nationals and expatriates ($P \geq 0.4$). One-quarter of the cases showed foci of lymphocytic thyroiditis in non-neoplastic areas, and all were females. There was no significant difference in the frequency of lymphocytic thyroiditis between UAE nationals and expatriates ($P \geq 0.2$). Seven cases of papillary carcinoma were diagnosed in association with Hashimoto's thyroiditis. All were females. Hashimoto's thyroiditis was seen more frequently among UAE expatriates (9%) than nationals (2%). Twenty-four cases (23%) showed multicentricity with the main mass and multiple foci seen in the same lobe in the majority of the cases ($n=18$). Both lobes were involved in six cases only. There were no significant differences in the frequency of multicentricity between UAE nationals and expatriates ($P \geq 0.5$).

Nineteen patients (14%) had follicular carcinoma, and fourteen cases (74%) were females. The mean age was 30.3 ± 13 years, the median 31 years, the range 13-48 years. Eleven cases (58%) were diagnosed before the age of 45 years. Nine cases presented as solitary thyroid nodules, 9 cases presented with multinodular goiter and only one case presented with metastasis to the lung. Six cases had T1 tumors, 8 had T2 tumors, 3 had T3 tumors and 2 had T4 tumor. Fifteen cases were of

the minimally invasive variant while 4 cases were of the widely invasive variant. Only one case showed lymphocytic thyroiditis in the non-neoplastic areas. The overall age and gender distribution is shown in Table 5. Two cases showed distant metastasis; one to the lung and the other to the brain.

A highly pleomorphic tumor affected two patients; the first patient was a 52-year old female with a tumor invading the perithyroid soft tissue and skeletal muscles and showing metastasis to the thoracic spines. The other patient was a 55-year old female with a tumor showing invasion of the perithyroid soft tissue.

One case only was diagnosed as medullary thyroid carcinoma (MTC) in a 37-year-old male patient. The tumor was localized within the thyroid gland and the patient had no family history of MTC. The adrenal gland was not affected by pheochromocytoma at the time of diagnosis.

DISCUSSION

Geographic variations in the distribution of different histopathologic types of thyroid carcinoma are well documented.⁸ In this study we analyzed a series of UAE indigenous and expatriate patients with thyroid carcinoma that had been referred to Tawam Hospital, which is the national referral oncology center in the UAE. This region of the Arabian Gulf has historically had a restricted pattern of migration; therefore, the native population represents a fairly homogenous ethnic group of Arab origin while the expatriate patients represent a heterogenous group of different ethnic origins. Most of our cases were diagnosed before the age of 45 years, and this is the same finding in other regional reports.¹⁻⁴ The prognosis for differentiated carcinoma is

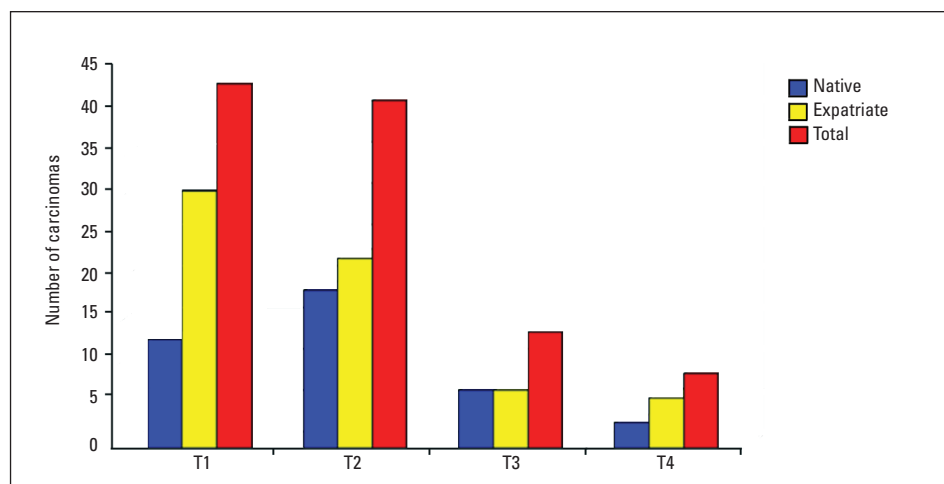


Figure 1. The distribution of papillary thyroid carcinomas according to the tumor size.

better for patients younger than 45 years of age without extracapsular extension.⁹ The overall mean age at presentation was 41 years, which is higher than that observed in reports from other Arab Gulf countries,^{1,2,4} but shows no significant differences from reports observed in Iran,^{3,10} India,¹¹ the United Kingdom,¹² and the USA,⁶ while the mean age at presentation among UAE nationals was 35.5 years, which is similar to the mean age in other Arabian Gulf countries.^{1,2,4} The overall peak incidence of TC was noticed in the fourth and fifth decades, which is similar to other Arabian Gulf countries, but the peak incidence of TC among nationals was noticed in the third decade which is a decade behind other regional studies.^{1,4} These findings suggest earlier presentation of UAE national cases which may predict prognostic influence.¹² Although a female preponderance was noticed in all the decades, which is the same finding in different studies all over the world, the female-to-male ratio among nationals is higher than other studies,^{1,5,11-12} while the gender ratio among expatriates is within the range of these studies. Female sex steroid hormones are known to influence the risk of breast cancer. The striking gender differences in the incidence of differentiated thyroid cancer, particularly for PTC, suggests a possible influence of hormone-related factors because the higher overall incidence of female PTC is established through a sharp increase during the child-bearing years of life. An increased risk of PTC has been seen among current users of oral contraceptives,¹³ whereas no such increase was evident among former users. In addition, estrogens are known to induce thyroid cancer in mice,¹⁴ providing further support for the hypothesis that incidence is hormone related.

The increase in PTC over time may have a similar etiological basis as the increase in female breast cancer

related to the increasing use of oral contraceptives and hormone replacement therapy.¹⁵ However, in a pooled analysis of case-control studies no association between hormone replacement therapy and thyroid cancer could be shown.¹⁵ We think that this finding of a high female preponderance of differentiated thyroid carcinoma among UAE nationals during the child-bearing age suggests a possible hormonal influence and needs to be more thoroughly investigated. However, the possibility of sampling bias should be considered, as we did not study all cases of thyroid carcinoma in the entire country. Papillary thyroid carcinoma is the commonest type followed by follicular carcinoma, anaplastic carcinoma and medullary carcinoma, and this is similar to other studies in Saudi Arabia,¹ Yemen,² Iran,³ Pakistan,¹⁶ Japan,¹⁷ Austria,¹⁸ United Kingdom,¹² Italy,¹⁹ and the United States (Figure 2).⁵ Variations in the relative frequency of each histological type have been noticed in these studies, which may be related to the geographical and sample variations or differences in the prevalence of risk factors. While in Sudan (Figure 2) FTC is the most common type, which may be related to the high incidence of endemic goiter and was seen in 93% of the cases in this study,²⁰ the frequency of each histologic type of TC is quite similar to Saudi Arabia,¹ which reflects the similarity of environmental factors in both communities. In addition, the histologic pattern of TC is similar among UAE nationals and expatriates suggesting that environmental factors are more important than genetic factors in the development of TC. PTC and FTC are separately influenced by dietary iodide, PTC being high in areas of high iodide intake and low in areas with low dietary iodide.²¹ The UAE is almost iodine sufficient in the urban areas. However, iodine deficiency, mild by urinary iodine concentration and moderate by thyroid

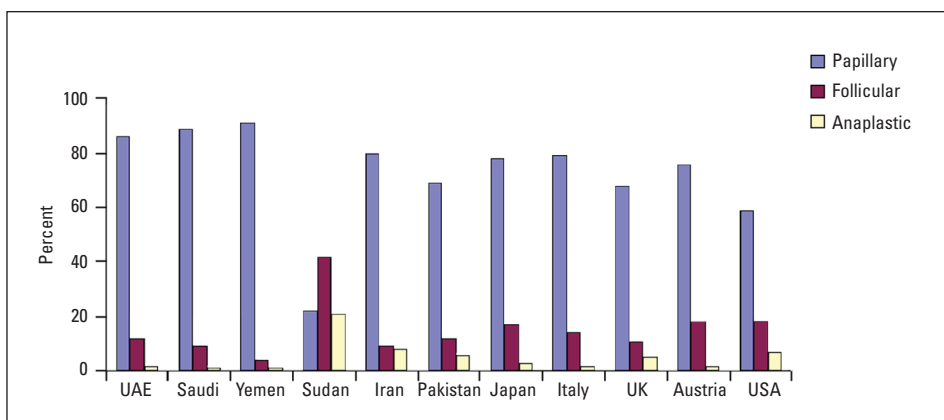


Figure 2. The relative frequencies of the histologic types of thyroid thyroid carcinoma in different studies.

volume, exists in the rural areas. Urban dwellers have gradually moved from their traditional lifestyle and eating habits to a more westernized type of lifestyle in the cities. In contrast, people in rural isolated communities still observe a traditional Bedouin lifestyle and rely mainly on their staple food consisting mainly of milk, dates, and locally grown porridge, and they might be iodine deficient.²² There was a significant difference in the mean age of PTC between UAE nationals and expatriates groups ($P < 0.01$), as PTC occurred at a younger age among UAE nationals. PTCs in young patients are usually expected to have a better prognosis.⁵ Clinically, multinodular goiter is the most common presenting feature of PTC among UAE nationals as well as expatriates, which is also seen in other regional reports.^{1,4} A significant numbers of PTCs have presented as solitary thyroid nodules, accounting for one quarter of the cases, and this finding is comparable among UAE nationals and expatriates as well as regional reports.^{1,4} In PTC a rough inverse relation is present between tumor size and prognosis, and in our study, about 80% of the cases had tumor sizes less than 4 cm in diameter, which is usually associated with a good prognosis.²³ There is a significant difference in tumor size categories between UAE nationals and expatriates ($P < 0.003$), since T2 cases outnumber T1 cases in UAE nationals while the reverse is seen among the UAE expatriates. The conventional and follicular variants of PTC predominate the histological pattern in our study, both among UAE nationals and expatriates, and both are usually associated with excellent prognosis.¹⁹ Only two cases were of the tall cell variant, which tends to affect older patients more often than the conventional form and the clinical course is said to be more aggressive.²⁴ Two-fourths of the PTC in our study were associated with cervical lymph node metastasis. There was no significant correlation between cervical lymph nodes involvement and

tumor size ($P > 0.05$). Although the frequency of cervical lymph node involvement was more common among UAE nationals than expatriates, it was not statistically significant ($P > 0.05$). The presence of cervical lymph nodes metastasis does not seem to worsen the prognosis.²⁵ Involvement of cervical lymph nodes is very common (particularly in young patients), and it may be the first manifestation of the disease. In our study, 7% of the cases presented with cervical lymphadenopathy as a first clinical sign and was more frequent among expatriates than nationals. In addition, nodal metastasis may not be clinically apparent because of their small size, but also because their consistency may not differ from that of a normal node. In a study of 67 patients with clinically negative nodes, 41 (61%) had a metastatic tumor on microscopical examination.²⁶ These findings explain the variability in the frequency of cervical lymph nodes involvement in PTC. Lymphocytic infiltration of the stroma was seen in one-fourth of our cases of PTC; however, it is not clear whether this represents a reaction to the tumor or the expression of pre-existing thyroiditis.²⁷ The interesting finding in this study is that all our patients with lymphocytic thyroiditis were females. Seven cases of PTC were associated with Hashimoto's thyroiditis, which was more frequent among expatriates (9%) than nationals (2%). There is convincing evidence of an increase in the incidence of PTC in Hashimoto's thyroiditis, but the wide variation in the figures quoted suggests that the diagnostic criteria vary just as widely.²⁸ Multiple microscopic foci of PTC are found in about one quarter of our PTC cases, which is the same finding in the Katoh et al study.²⁹ Variation in the frequency is expected and depends on the sampling of the specimens.²⁹ Controversy still exists as to whether this represents multicentricity or intrathyroidal lymphatic permeation, but probably both mechanisms operate. A study conducted on PTC in Florence, Italy,²³ had shown that

patients in whom multicentricity is a prominent feature have a greater incidence of metastasis and a lesser chance of disease-free survival.²³ FTC is the second common form of TC, but its prevalence is very low in comparison with PTC. There was no significant difference in the frequency of FTC between UAE nationals and expatriates, reflecting the similarity in the environmental factors. Although FTC shares with the PTC the same predilection for females, there are marked geographical variations in the relative proportions of FTC and PTC, most likely related to dietary iodine content. In iodine-deficient areas, the relative rate of FTC tends to be increased.³⁰ The other risk factors for FTC include age over 50 years and female sex.³⁰ Genetic factors may also have a role in determining disease susceptibility but remain ill-defined.³⁰ In our study three-quarters of the cases were females, two-thirds were below the age of forty-five years and most were of the minimally invasive type, which predicts an excellent prognosis.³⁰ Two of our cases of FTC had distant metastasis, one to the brain and the other to the lung. The interesting finding histologically was the highly differentiated appearance of the metastatic neoplasms mimicking normal or mildly hyperplastic thyroid follicles. The follicles contained colloid material and the follicular cells did not show any cytologic atypia. ATC is a rare tumor in our study, which usually presents in elderly patients as a rapidly growing mass associated with hoarseness, dysphagia, and dyspnea. Extrathyroid extension at the time of initial presentation is seen in most of the cases as in ours and is associated with poor prognosis.³¹ MTC is also rare in our study, which was seen in only one case, and did not show any family history and appeared to be sporadic.

Management of well-differentiated thyroid carcinoma at our institution is usually the responsibility of a specialist multidisciplinary thyroid team. Treatment modalities usually include surgery, radioactive iodine ablation, external beam radiotherapy, hormonal suppressive treatment or combinations. Surgery is the treatment of choice for well-differentiated thyroid cancer in the United Arab Emirates. However, the extent of thyroid surgery is controversial and the surgical management of clinical and occult nodal metastasis is also controversial.

In general, two management philosophies have been proposed for the treatment of the primary tumor in well-differentiated thyroid carcinoma; the conservative approach and the aggressive approach. Proponents of the aggressive approach recommend a total or near total thyroidectomy in most cases; lobectomy is only acceptable for small, single lesions. Proponents of the conser-

vative approach base the extent of thyroid surgery on prognostic indicators and recommend hemithyroidectomy for the low-risk group, which usually includes more than 80% of all patients. More extensive thyroid surgery is recommended for the high-risk group.

Many surgeons suggest that the ideal thyroid operation for differentiated cancer is a total thyroidectomy.³²⁻³⁵ Some authors found that a total thyroidectomy often revealed multicentric disease and could be done with minimal morbidity, whereas other authors reported a survival advantage with the more aggressive approach even in the low-risk group.³⁶⁻³⁹ American College of Surgeons (ACS) researchers, Bilimoria and co workers, who analyzed 13 years of data from the National Cancer Database (NCDB), have recently concluded that total thyroidectomy results in lower recurrence rates and improved survival for patients with tumors that measure greater than 1.0 cm.⁴⁷

The incidence of neck metastasis in well-differentiated thyroid carcinoma has been reported to be as high as 90%.⁴⁰ The recommended treatment for clinical metastasis is the appropriate conservative neck dissection. Many options mentioned for occult disease include expectant management or elective treatment with either neck dissection, hormonal suppression or radioactive iodine (RAI) ablation.⁴¹⁻⁴³ The clinical implications of nodal disease on presentation are controversial with some authors reporting an influence only on tumor recurrence^{35,44,45} and still others reporting a detrimental effect on survival.^{23,33,44}

Extrathyroidal extension is a well recognized sign of poor prognosis.⁴⁵ In general, total thyroidectomy followed by radioactive iodine treatment, external irradiation and hormonal suppression is recommended. Radioactive iodine treatment (RAIT) can be used in the management of thyroid cancer not only for thyroid ablation after thyroidectomy, but also for the treatment of nodal and distant metastases, and tumor recurrence.^{32,46} The use of external radiation is limited to gross residual tumor after surgery and to unresectable tumors that do not take RAIT.

Among nationals of the United Arab Emirates, thyroid carcinomas seem to be more common among females with a high female-to-male ratio among UAE nationals, suggesting that female gender might probably be a risk factor in their development. Since two-thirds of our cases were diagnosed before the age of 45 years, which is usually associated with a good prognosis, this relative youth (age <45 years) can be simultaneously considered as an important favorable prognostic factor and a possible risk factor. Another remarkable finding is that PTC, which has a higher incidence in iodide suf-

ficient areas, was the most frequent histologic pattern among all thyroid carcinomas managed at our institution. We believe that our results probably represent a satisfactory model for the distribution of thyroid can-

cer in iodine sufficient areas, which explains the lower occurrence of FTC and ATC in our study. The significance of this pattern of distribution lies in the fact that PTC has a better prognosis than FTC and ATC.

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