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Impact of gender and age on the risk and clinical characteristics of thyroid cancer: A Retrospective Study at King Abdulaziz University Hospital, Jeddah

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Abstract

Background and Aim: Thyroid cancer incidence has been increasing in Saudi Arabia, with variation by age and sex. This study aimed to evaluate the association of age and sex with clinicopathologic characteristics and outcomes of thyroid cancer.

Methods: We conducted a retrospective medical record review of adult patients with confirmed thyroid cancer diagnosed and/or treated at King Abdulaziz University Hospital, Jeddah, between January 2010 and December 2023. Demographic data, tumour characteristics, treatment, and outcomes were extracted. Statistical analyses were performed using SPSS version 26.

Results: Among 331 patients, papillary carcinoma was the most common histologic subtype. Older age at diagnosis was associated with more advanced stage, larger tumour size, and documented distant metastasis. Male patients were older at diagnosis and had larger tumours, and sex was associated with lymph node metastasis and invasion of adjacent structures.

Conclusion: In this single-center retrospective cohort, age and sex were associated with thyroid cancer characteristics and selected outcomes. These findings support considering age and sex when interpreting disease extent and planning follow-up, while recognizing the limitations of retrospective observational data.

Keywords: Thyroid cancer; Papillary thyroid carcinoma; Age; Sex; Metastasis.

1. Introduction

Thyroid cancer is a significant health concern and is the most common malignancy arising from hormone-producing glands (1). Although most thyroid lesions are benign, malignant thyroid tumours—including papillary, follicular, medullary, and anaplastic carcinomas—remain clinically important and may present with neck swelling or thyroid nodules (2). Accurate diagnostic evaluation is therefore essential, and fine-needle aspiration cytology (FNAC) is widely used to support timely assessment and management (3).

Globally, thyroid cancer incidence has increased over recent decades, with marked geographic variation and consistent differences by sex and age (4). Thyroid cancer–specific mortality has also been reported to increase in some populations, with greater rises among men and in patients with larger tumours (2–4 cm) (5). Multiple risk factors have been proposed—including genetic susceptibility, iodine intake, thyroid-stimulating hormone level, autoimmune thyroid disease, obesity, and environmental or lifestyle factors—yet many of these are not routinely or consistently captured in retrospective hospital-based datasets, which typically emphasize measurable demographic and clinicopathologic variables (6).

In Saudi Arabia, thyroid cancer incidence has increased notably over time, underscoring the importance of defining local epidemiology and clinicopathologic patterns (7,8). Prior reports indicate higher incidence among females and a substantial increase among males, highlighting the need for increased awareness and timely diagnosis in both sexes (8). Studies from Saudi Arabia also suggest that thyroid cancer may be diagnosed at a younger age and with larger tumour size compared with some other settings, with limited evidence of a trend toward smaller tumours over time (9).

In addition, thyroid cancer has been associated with quality-of-life impairment and symptom burden in local populations (10). Despite this growing burden, important gaps remain in understanding how age and sex relate to tumour characteristics and key clinical outcomes in specific Saudi populations, including patients in Jeddah.

Therefore, this retrospective study aimed to evaluate the association of age and sex with thyroid cancer clinicopathologic features and outcomes among adult patients with confirmed thyroid cancer diagnosed and/or treated at King Abdulaziz University Hospital, Jeddah, between January 2010 and December 2023. The study focused on variables captured in the medical record, including histologic type, tumour size, stage, lymph node metastasis, invasion of adjacent structures, documented distant metastasis, treatment and response, and recurrence.

2. MATERIALS AND METHODS:

Study design and setting: This retrospective medical record review was conducted at King Abdulaziz University Hospital (KAUH), Jeddah, Saudi Arabia, and was reported in accordance with the STROBE guidelines for observational studies. The study period extended from January 2010 through December 2023.

Study population and eligibility: We included all adult patients (≥18 years) with confirmed thyroid cancer who were diagnosed and/or treated at KAUH during the study period. Patients aged <18 years were excluded. The presence of other malignancies, when documented in the medical record, was extracted and analyzed as a study variable. All consecutive eligible cases available in the hospital records were included; therefore, no formal sample size calculation was performed.

Data collection and variables: Patient demographic and clinical data were extracted from electronic and paper medical records. Data were recorded using a standardized data collection form and subsequently organized in a spreadsheet for analysis. Variables collected included sex, age at diagnosis, histologic type, tumour size, lymph node metastasis, invasion of adjacent structures, documented distant metastasis, AJCC/TNM stage, diagnostic method, family history of thyroid

cancer, treatment modality, response to treatment, recurrence, prior thyroid-related conditions or abnormalities, prior thyroid-related screenings or tests, presence of other cancers, other endocrine disorders, number of affected lymph nodes (where applicable), and follow-up duration.

Statistical analysis: Data were entered and analyzed using SPSS (version 26). Categorical variables were summarized as frequencies and percentages, and continuous variables as mean ± standard deviation (SD). Categorical variables were compared using the chi-square test. Continuous variables were compared using the independent-samples t-test (two groups) or one-way ANOVA (three or more groups), as appropriate. A two-sided p-value <0.05 was considered statistically significant.

Ethical approval and confidentiality: Ethical approval was obtained from the Unit of Biomedical Ethics, Research Ethics Committee (REC), Faculty of Medicine, King Abdulaziz University, Jeddah, Saudi Arabia (Reference No. 140-24). Patient identifiers were not collected. To ensure confidentiality, records were anonymized and stored securely with access restricted to the research team. As this was a retrospective review using de-identified data, informed consent was waived in accordance with institutional policy.

3. RESULTS:

Sample characteristics

A total of 331 patients with thyroid cancer were included; 71 (21.5%) were male and 260 (78.5%) were female. Papillary carcinoma was the predominant histologic subtype (87.6%, n=290), followed by follicular (7.6%, n=25), medullary (3.0%, n=10), anaplastic (1.2%, n=4), and Hürthle cell carcinoma (0.6%, n=2). Lymph node metastasis was documented in 29.3% (n=97), invasion of adjacent structures in 16.0% (n=53), and distant metastasis in 7.3% (n=24). Most patients were diagnosed at stage I (78.9%, n=261). Summary descriptive statistics are presented in Tables 1–3.

Gender differences

Histologic subtype distribution did not differ significantly by sex (Table 4). Lymph node metastasis and invasion of adjacent structures differed significantly by sex (Table 4). Males were older at diagnosis and had larger tumours than females (Table 5). Treatment response also differed by sex (Table 4). No significant sex differences were observed in stage, diagnostic method, family history of thyroid cancer, documented distant metastasis, recurrence, other cancer diagnoses, or other endocrine disorders (Table 4).

Age at diagnosis and tumour aggressiveness /outcomes

Age at diagnosis differed significantly across histologic subtypes (Table 6). Older age at diagnosis was significantly associated with markers of more advanced disease, including higher stage, invasion of adjacent structures, and documented distant metastasis (Table 6). Age at diagnosis was also associated with lymph node metastasis (Table 6). Tumour size showed a modest positive correlation with age at diagnosis (Table 7), while follow-up duration and the number of affected lymph nodes were not significantly correlated with age or tumour size (Table 7).

4. Discussion

Thyroid cancer in this retrospective cohort from King Abdulaziz University Hospital was diagnosed predominantly in women, and papillary carcinoma accounted for the large majority of cases. This overall pattern aligns with international and regional reports describing higher diagnosed incidence among females and a predominance of differentiated (particularly papillary) thyroid carcinoma [14,16,21]. The female predominance in diagnosed cases is consistently observed across studies and is commonly attributed to a combination of biological and healthcare-related factors; however, these underlying drivers were not directly measurable in our dataset and therefore cannot be evaluated in this analysis [16,17]. Within Saudi Arabia, rising incidence and variation by sex and region have been reported, underscoring the relevance of institution-based

studies that characterize clinicopathologic patterns in specific local populations [7,8,14].

Beyond distribution, our findings support the clinical relevance of sex and age as correlates of tumour characteristics and outcomes. In sex-stratified comparisons, males were older at diagnosis and had larger tumours than females, consistent with prior literature suggesting that men often present at older ages and may exhibit less favourable tumour features [22,23]. We also observed significant sex differences in lymph node metastasis and invasion of adjacent structures on univariable analysis (Table 4), alongside differences in age at diagnosis and tumour size (Table 5). At the same time, published evidence on sex differences in aggressiveness and outcomes is heterogeneous, and differences may reflect case mix, diagnostic intensity, and follow-up practices across settings [31,32]. Accordingly, our results should be interpreted as associations within a single-center cohort rather than definitive estimates of sex-based risk.

Age at diagnosis showed a consistent relationship with markers of disease extent. Older patients were more likely to present with advanced stage and were more frequently associated with invasion of adjacent structures and documented distant metastasis; age was also positively associated with tumour size, and these associations were observed in univariable analyses (Table 6–7). These observations align with the well-established prognostic importance of age in thyroid cancer and prior reports linking older age with more advanced disease features (19,20,27–30). We also identified significant associations between age (and sex) and treatment response, although the direction and magnitude of such associations vary across studies, including those from the region (23–26). Clinically, these findings support maintaining heightened diagnostic and follow-up vigilance for older adults and for groups more likely to present with larger tumours, while recognizing that the present retrospective design does not allow causal inference.

This study has limitations inherent to retrospective, single-center chart reviews. Data completeness depended on existing documentation, and some potentially important covariates were not consistently available or measurable (e.g., detailed risk-factor exposures, standardized treatment protocols over time), which may introduce residual confounding. The cohort was drawn from a teaching/referral hospital, limiting generalizability to the wider community. In addition, follow-up duration varied, which may affect observed outcome frequencies such as recurrence. Despite these limitations, the study provides institution-specific evidence describing how age and sex relate to tumour characteristics and selected outcomes in a large local cohort, and it highlights areas for future multicenter studies with standardized data capture to validate and extend these findings.

5. Conclusion:

In this retrospective single-center study of adult patients with thyroid cancer diagnosed and/or treated at King Abdulaziz University Hospital, Jeddah (2010–2023), older age at diagnosis was associated with larger tumours and more advanced disease features, including higher stage, invasion of adjacent structures, and documented distant metastasis. Male patients were diagnosed at an older age and had larger tumours than female patients. In addition, age and sex were associated with treatment response within this cohort. These findings support considering age and sex when interpreting tumour characteristics and planning follow-up, while recognizing that the retrospective design limits causal inference and that multicenter studies are needed to confirm these associations.

Declarations

Conflict of Interest:

The authors declare no conflict of interest.

Funding:

This research received no external funding.

Ethical Approval:

The study was Approved by the Unit of Biomedical Ethics, Research Ethics Committee (REC), Faculty of Medicine, King Abdulaziz University, Jeddah,

Saudi Arabia (Reference No. 140-24). All data were anonymized and handled in accordance with institutional ethical standards.

Patient Consent:

Patient consent was waived as the study used de-identified, retrospective data.

Author Contributions:

All authors contributed to the study's conception, data collection, analysis, and manuscript preparation. All authors read and approved the final version of the manuscript.

Author Approval for Submission:

All authors and co-authors have reviewed and approved the final manuscript, and its submission has been made with their full knowledge and consent.

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Table 1: SAMPLE CHARACTERISTICS:

		n	%
Gender	Male	71	21.5%
	Female	260	78.5%
Histologic type of thyroid cancer	Papillary carcinoma	290	87.6%
	Follicular carcinoma	25	7.6%
	Medullary carcinoma	10	3.0%
	Anaplastic carcinoma	4	1.2%
	Hurthle cell carcinoma	2	0.6%
Presence of lymph node metastasis	No	234	70.7%
	Yes	97	29.3%
Invasion of adjacent structures or tissues	No	278	84.0%
	Yes	53	16.0%
documented distant metastasis?	No	307	92.7%
	Yes	24	7.3%
diagnostic methods	Fine needle aspiration	313	94.6%
	Bipat	1	0.3%
	Total thyroidectomy	5	1.5%
	Subtotal thyroidectomy	6	1.8%
	Near total thyroidectomy	1	0.3%
	Histopathology	3	0.9%
	Diagnosed outside	2	0.6%
family history of thyroid cancer	No	321	97.0%
	Yes	10	3.0%

	Total thyroidectomy	265	80.3%
	Subtotal thyroidectomy	57	17.3%
	Radioactive iodine therapy	5	1.5%
	Chemotherapy	2	0.6%
	Other	1	0.3%
	Complete remission	229	69.2%
	Partial remission	35	10.6%
	Stable disease	38	11.5%
	Disease progression	29	8.8%
	No	288	87.0%
	Yes	43	13.0%
	No	245	74.0%
	Yes	86	26.0%
	No	308	93.1%
	Yes	23	6.9%
	No	307	92.7%
	Yes	24	7.3%
	No	300	90.6%
	Yes	31	9.4%

Table 2: Stage of Thyroid Cancer

Cancer stage	n	%
I	261	78.9
II	15	4.5
III	19	5.7
IVa	12	3.6
IVb	5	1.5
IVc	14	4.2

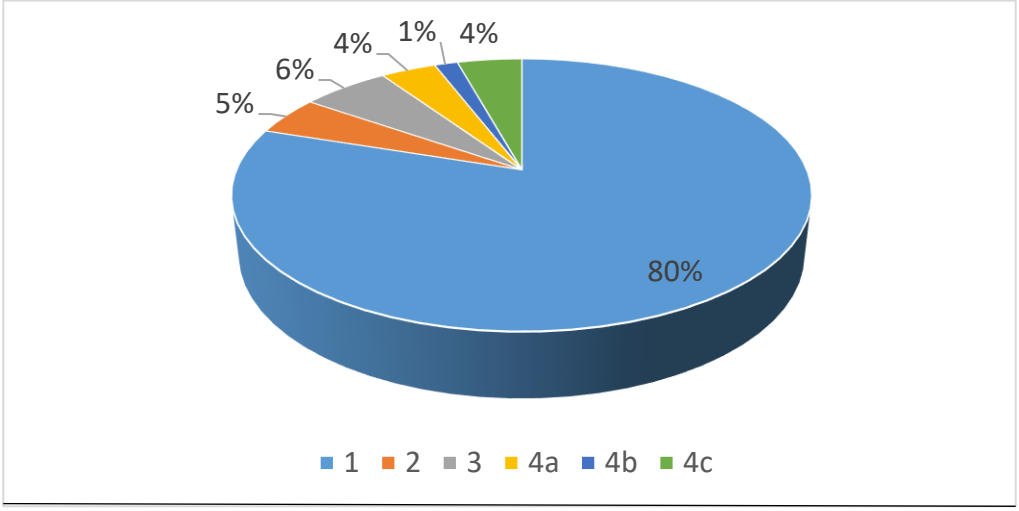

Figure 1: Stage of Thyroid Cancer distribution in the sample

Table 3 Age at diagnosis, follow-up tumour size, and lymphatic invasion:

	Mean	Standard Deviation
Age at diagnosis	43.55	14.73
Tumour size (cm)	2.34	2.09
Number of affected lymph nodes	6.47	6.90
Follow-up duration in months	40.31	36.83

Table 4: Gender differences in clinical characteristics

		Gender					
		Male		Female			
		n	%	n	%	chi square	p value
Histologic type of thyroid cancer	Papillary carcinoma	60	18.1%	230	69.5%	6.38	0.173
	Follicular carcinoma	4	1.2%	21	6.3%		
	Medullary carcinoma	5	1.5%	5	1.5%		
	Anaplastic carcinoma	1	0.3%	3	0.9%		
	Hurthle cell carcinoma	1	0.3%	1	0.3%		
Presence of lymph node metastasis	No	40	12.1%	194	58.6%	8.99	0.003
	Yes	31	9.4%	66	19.9%		
Invasion of adjacent structures or tissues	No	54	16.3%	224	67.7%	4.23	0.040
	Yes	17	5.1%	36	10.9%		
documented distant metastasis	No	61	18.4%	246	74.3%	6.28	0.120
	Yes	10	3.0%	14	4.2%		
Stage of thyroid cancer:	I	49	15.0%	212	65.0%	10.61	0.600
	II	6	1.8%	9	2.8%		
	III	5	1.5%	14	4.3%		
	IVa	4	1.2%	8	2.5%		
	IVb	0	0.0%	5	1.5%		
	IVc	6	1.8%	8	2.5%		
diagnostic methods	Fine needle aspiration	69	20.8%	244	73.7%	2.07	0.914
	Bipat	0	0.0%	1	0.3%		

	Total thyroidectomy	1	0.3%	4	1.2%		
	Subtotal thyroidectomy	1	0.3%	5	1.5%		
	Near total thyroidectomy	0	0.0%	1	0.3%		
	Histopathology	0	0.0%	3	0.9%		
	Diagnosed outside	0	0.0%	2	0.6%		
family history of thyroid cancer	No	69	20.8%	252	76.1%	0.01	0.910
	Yes	2	0.6%	8	2.4%		
Treatment received	Total thyroidectomy	57	17.3%	208	63.0%	1.25	0.870
	Subtotal thyroidectomy	12	3.6%	45	13.6%		
	Radioactive iodine therapy	1	0.3%	4	1.2%		
	External beam radiation therapy	0	0.0%	0	0.0%		
	Chemotherapy	1	0.3%	1	0.3%		
	Targeted therapy	0	0.0%	0	0.0%		
	Other	0	0.0%	1	0.3%		
Response to treatment:	Complete remission	45	13.6%	184	55.6%	10.48	0.015
	Partial remission	3	0.9%	32	9.7%		
	Stable disease	13	3.9%	25	7.6%		
	Disease progression	10	3.0%	19	5.7%		
Recurrence:	No	57	17.2%	231	69.8%	3.62	0.057
	Yes	14	4.2%	29	8.8%		
prior thyroid-related conditions or abnormalities	No	59	17.8%	186	56.2%	3.88	0.049
	Yes	12	3.6%	74	22.4%		
Any documented prior thyroid-related screenings or tests	No	64	19.3%	244	73.7%	1.18	0.276
	Yes	7	2.1%	16	4.8%		

Any other types of cancer diagnoses mentioned in the medical records	No	65	19.6%	242	73.1%	0.19	0.660
	Yes	6	1.8%	18	5.4%		
Any other endocrine disorders diagnosed or mentioned in the medical records	No	65	19.6%	235	71.0%	0.09	0.765
	Yes	6	1.8%	25	7.6%		

Table 5: Gender differences in clinical characteristics (continuous outcomes)

	Gender					
	Male		Female			
	Mean	Sd	Mean	Sd	t test	p value
Age at diagnosis	48	16	42	14	2.580	0.011
Tumour size (in cm)	2.89	2.43	2.19	1.97	2.045	0.044
Number of affected lymph nodes	7	7	6	7	0.338	0.737
Follow-up duration (months)	35	32	42	38	-1.468	0.145

Table 6: Age at diagnosis across clinicopathologic characteristics and outcomes (mean ± SD) with p-values for group comparisons.

	Age at diagnosis			
		Mean	Sd	P value
Histologic type of thyroid cancer	Papillary carcinoma	42.80	14.29	<0.001
	Follicular carcinoma	47.12	15.39	
	Medullary carcinoma	47.80	13.15	
	Anaplastic carcinoma	67.25	26.12	
	Hurthle cell carcinoma	39.00	19.80	
Presence of lymph node metastasis	No	42.37	13.27	0.004
	Yes	46.39	17.53	
Invasion of adjacent structures or tissues	No	42.36	13.73	0.015
	Yes	49.77	18.06	
distant metastasis	No	42.82	14.26	<0.001
	Yes	52.92	17.61	
Stage of thyroid cancer:	I	39.16	11.37	<0.001
	II	44.53	16.54	
	III	63.89	9.19	
	IVa	68.58	8.93	
	IVb	69.20	6.14	

	IVc	65.29	7.15	
Diagnostic methods used	Fine needle aspiration	43.78	14.69	0.106
	Bipat	37.00	0.00	
	Total thyroidectomy	31.80	11.05	
	Subtotal thyroidectomy	43.00	15.61	
	Near total thyroidectomy	47.00	0.00	
	Histopathology	37.00	24.27	
	Diagnosed outside	50.00	21.21	
family history of thyroid cancer	No	43.70	14.81	0.881
	Yes	38.60	11.60	
Treatment received	Total thyroidectomy	43.46	14.55	<0.001
	Subtotal thyroidectomy	41.72	13.43	
	Radioactive iodine therapy	65.20	17.94	
	Chemotherapy	48.00	19.80	
	Other	75.00	0.00	
Response to treatment	Complete remission	42.28	13.56	0.007
	Partial remission	42.71	16.79	
	Stable disease	44.26	14.30	
	Disease progression	53.69	18.12	
Recurrence	No	43.08	14.53	0.168
	Yes	46.72	15.85	
prior thyroid-related conditions or abnormalities	No	44.06	15.37	0.469
	Yes	42.10	12.73	
	No	43.56	14.80	0.587
prior thyroid-related screenings or tests	No	43.56	14.80	0.587
	Yes	43.39	14.17	
other types of cancer diagnoses mentioned in the medical records?	No	42.85	14.75	0.256
	Yes	52.54	11.39	
Other endocrine disorders diagnosed or mentioned in the medical records?	No	42.27	14.34	<0.001
	Yes	55.94	12.81	

Table 7: Correlation matrix of continuous study variables.

Correlations					
		Age at diagnosis	Tumour size(cm)	Number of affected lymph nodes	Follow-up duration (months)
Age at diagnosis	r	1	.204**	-0.111	-0.054
	p		0.001	0.382	0.357
Tumour size(cm)	r	.204**	1	0.199	0.008

	p	0.001		0.141	0.897
Number of affected lymph nodes	r	-0.111	0.199	1	0.018
	p	0.382	0.141		0.894
Follow-up duration (months)	r	-0.054	0.008	0.018	1
	p	0.357	0.897	0.894	
Values are Pearson correlation coefficients (r) with two-tailed p values. *p < 0.05; **p < 0.01.					