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Research Article

Histopathologic Pattern of Thyroid Disease in 1351 Thyroidectomy Patients

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Abstract

Background Thyroid disease poses a major clinical problem. Knowledge of the pattern and distribution of thyroid disease is important to establish prevention and treatment protocols. This is hampered by lack of data.

Methods This is a retrospective descriptive study of histopathology reports on thyroid tissue surgically excised from patients over a 10-year-period (from 2009-2020) at a major teaching hospital. Demographic data on patients included the age, gender, geographical location and ethnic origin.

Results A total of 1351 histopathological reports on thyroid patients were studied. Twenty one patients (1.6%) had thyroglossal cysts and 1330 patients (98.4%) had goiters. The mean age was 40.6 years (SD±13.25), (range 11-85years). The majority (88%) were females Most of our patients come from Khartoum (76.3%), followed by White Nile (6.4%), and El Gazira states (4.5%). The commonest ethnic groups affected were the Nuba (11.6%) and Jaalin (8%). The majority of patients (85%) had benign thyroid diseases, and only (15%) had neoplastic disease. Simple multinodular goiter (SMNG) accounted for (78.6%) of benign thyroid disease. Follicular adenoma was the commonest benign neoplasm (98%), whereas papillary carcinoma was the commonest malignant tumour (44.9%), followed by follicular carcinoma and Hurthle cell tumours (43.9%). Medullary and anaplastic carcinomas each accounted for (4.1%) of patients.

Conclusions The study identified the histopathological pattern of thyroid disease. SMNG was the commonest benign disease. Follicular and Hurtle cell carcinoma combined were almost as frequent as papillary carcinoma. Prevention of SMNG by iodinization, early detection of thyroid neoplasms, and studies on goitrogens should be activated.

Keywords: Thyroid disease, histopathology, thyroglossal cyst, goiter, thyroid cancer, thyroidectomy, Sudan, multinodular colloid goiter, thyroid adenoma.

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1. Introduction

Thyroid disease poses a major clinical problem in our country. The overall prevalence of endemic goiter has increased from 22% (range 13-87%) to 38.8% (12.2-77.7%) despite all programs for the control of iodine deficiency disorders [1, 2].

Currently, thyroid surgery is performed in almost every surgical operative list in major hospitals across the country. In addition, goiter is a standard case in clinical examinations in surgery and medicine, both at the undergraduate OSCE and postgraduate MD levels. Areas far from the sea, particularly the western parts (Darfur state), have been endemic to iodine deficiency [2-4]. This is so much so that local folklore poetry glorifies a large neck as a sign of charm and beauty of women. Kosti city (White Nile State), though nearer to the sea than Darfur, has been found to have the highest prevalence of the disease [2]. Historically, goiter was thought to be introduced into Africa in the 19^{th} or even 20^{th} century and got prevalent in Sennar by 1825 [5].

Omdurman city forms one of the three major cities of the capital Khartoum. It is a cosmopolitan city inhabited by millions of people coming from all regions of Sudan. Omdurman Teaching Hospital (OTH) is thus visited by a great variety of patients of variable ethnicity.

Establishing a data base as well as identifying the pattern of thyroid disease and its distribution in the country helps policymakers to plan preventive and early detection measures as well as protocols of management. The objective of this study was to identify the pattern of the histopathology of thyroid disease in thyroid tissue samples removed surgically at OTH. To our knowledge, this is the largest collection of samples being studied and analyzed.

2. Materials and Methods

This is a retrospective descriptive study of histopathology reports on thyroid tissue surgically excised from patients over a 10-year period (from 2009 to 2020). Demographic data on patients included the age, gender, geographical location, and ethnic origin.

Statistical analysis of the data was done using IBM SPSS Statistics for Windows, version 25 (IBM Corp., Armonk, N.Y., USA).

3. Results

A total of 1351 histopathological results were included. Twenty-one patients (1.6%) had thyroglossal cysts and 1329 patients (98.4%) had goiter. The mean age of all the patients

was 40.6 years (SD±13.25), range (11-85 years). The majority (88%) were females giving a ratio of female to male ratio of 7.3:1.

The mean age for patients undergoing an operation for thyroglossal cysts was 35.9 (16.6), range (14-75 years) with almost equal female (F) to male (M) ratio; 1.1F:1M.

The mean age of patients with benign (non-neoplastic) goiters was 40.5 (12.7), range (12-85) years. The mean age of patients with neoplastic goiters was 41.6 (15.4), range (11-80) years. The differences were not statistically significant between the ages of simple (non-neoplastic) and neoplastic goiters (p=0.278), as well as between simple and thyroglossal cyst patients (p=0.102).

Most of our patients come from Khartoum state (76.3%). This was followed by the states of White Nile (6.4%), and El Gazira states (4.5%). The commonest ethnic groups affected were Nuba (11.6%) followed by the Jaalin tribes (8%). The distribution of patients in Sudan is shown in the map (Figure 1).

The general pattern of thyroid disease is shown (Table 1). The majority of patients (85%) had simple benign thyroid diseases, while neoplastic thyroid disease (both malignant and benign) accounted for 15% of the patients (Figure 2).

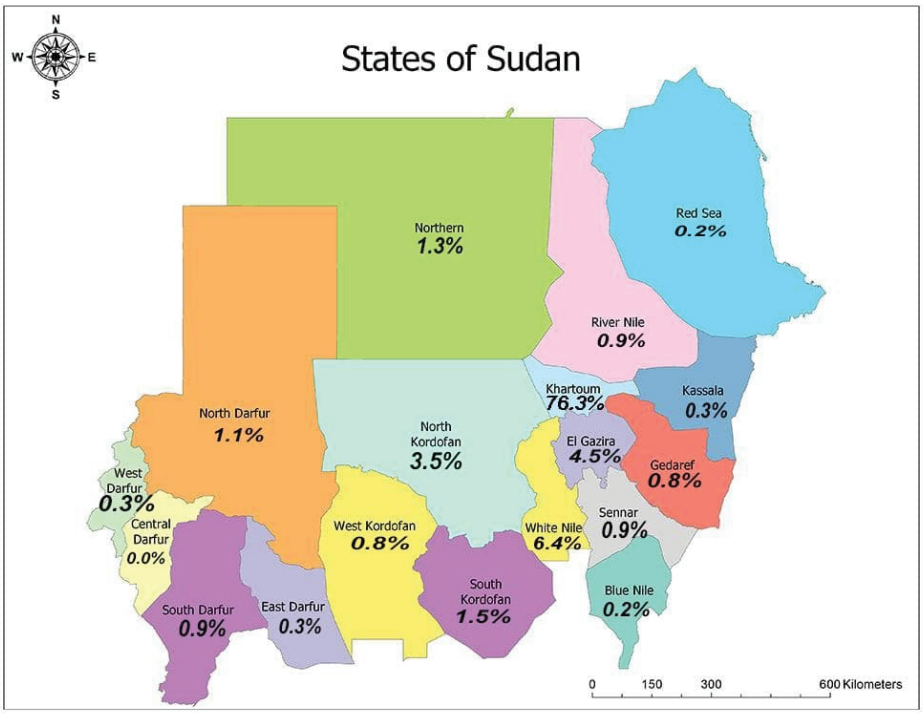

Figure 1: Distribution of thyroid diseases in Sudan.

Generally, SMNG and colloid goiters predominate 75.5%. All thyroid cancers accounted for 7.3% of the specimens, whereas follicular adenomas were 7.1%. Inflammatory thyroid disease accounted for 3.2%. Toxic thyroid disease accounted for 1.8%, of

TABLE 1: Pattern of thyroid disease.

Histopathology		
	Frequency	**Percentage**
Multinodular goiter	837	62.9
Simple colloid goiter	182	13.7
Simple physiological goiter	45	3.4
Toxic Nodule	3	.2
Toxic multinodular goiter	20	1.5
Toxic diffuse goiter	2	.2
Inflammatory goiter (Thyroiditis)	43	3.2
Follicular adenoma	97	7.3
Metastatic carcinoma	2	.2
Medullary carcinoma	4	.3
Anaplastic carcinoma	4	.3
Hurthle type carcinoma	15	1.1
Papillary carcinoma	44	3.3
Follicular carcinoma	28	2.1
Mixed carcinoma	1	.1
Hylined trabecular adenoma	2	.2
Non conclusive sample	1	.1
Total	**1330**	**100.0**

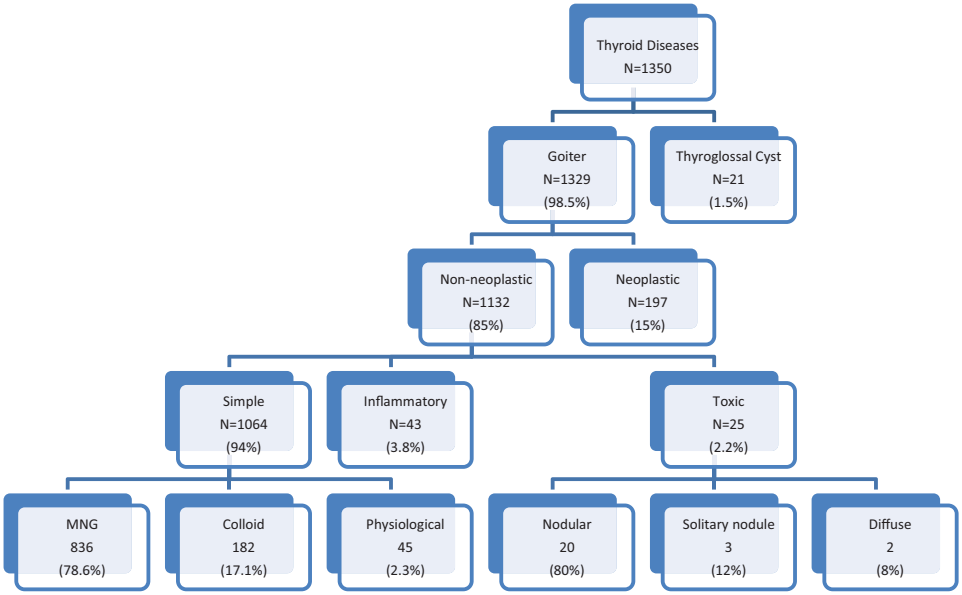

Figure 2: Thyroid disease: General pattern.

which nodular thyroid disease being the most common 1.5%, and diffuse goiters being the least common (0.1%).

In the category of benign thyroid disease, simple multinodular goiter (SMNG) accounted for 78.6% of benign thyroid diseases. Thyroid neoplasms (benign and

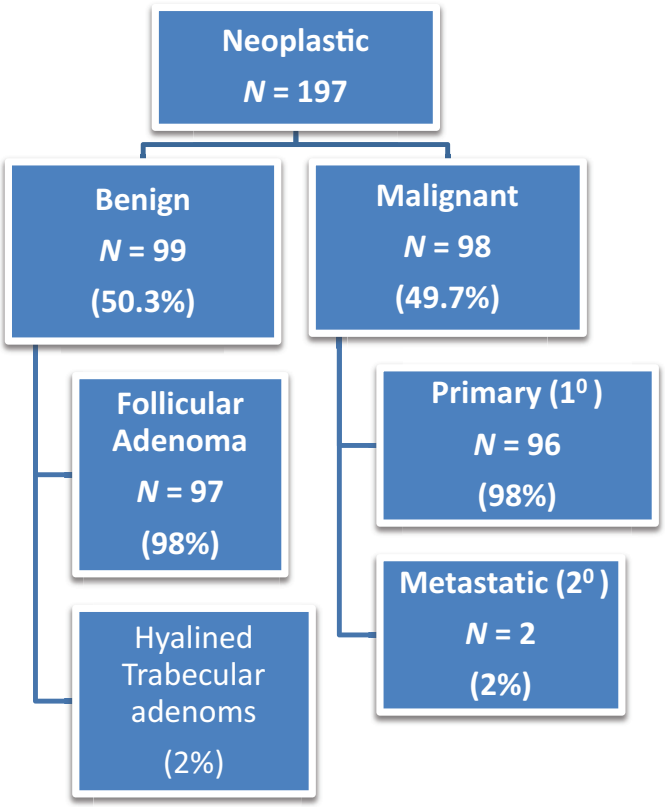

Figure 3: Neoplastic thyroid disease.

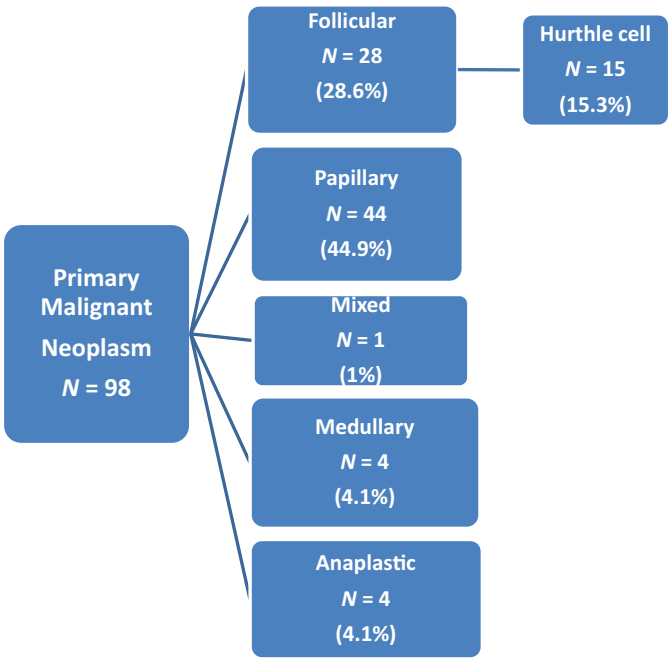

Figure 4: Primary malignant thyroid disease.

malignant) accounted for nearly equal proportions (50.3 percent and 49.7 percent, respectively) Thyroid neoplasms (benign and malignant) accounted for nearly equal

Table 2: Mean age, gender and non-neoplastic vs neoplastic ratios.

Study	Mean age (SD)	F:M ratio	Non-neoplastic %	Neoplastic %
El Shallaly (Sudan) (2009–2020) *N* = 1330	40.5 (13.25)	7.3:1	85	15
Koyuncuire (Turkey) (2006–2014) *N* = 1149	41.41 (12.29)	7.9:1	86.9	13.1
Tsegaye (Ethiopia) 1994–1998 *N* = 780	NR	4.5:1	79	21
Al-Wageeh (Yemen) 2014–2015 *N* = 260	40.06 (13.18)	9:1	68.5	31.5
Chayla *et al.* (Tanzania) (2008–2010) *N* = 152	38.4 (12.5)	11.7:1	85.5	14.5

Table 3: Comparison pattern of thyroid disease.

	Nodular colloid goitre	Adenoma	Carcinoma	Thyroiditis	Toxic
El Shallaly (Sudan) (2009–2020) *N* = 1330	76.6%	7.5%	7.4%	3.2	1.9
Tsegaye (Ethiopia) (1994–1998) *N* = 780	76.9	12.8	8.2	2.1	NR
Chayla *et al.* (Tanzania) (2008–2010) *N* = 152	76.3	6.6	7.9	1.3	7.9
Koyuncuire (Turkey) (2006–2014) *N* = 1149	81.7	4.8 (follicular)	8.4	4.2	0.4 (Grave's)
Al-Wageeh (Yemen) 2014–2015 *N* = 260	63.1	4.6	26.9	5.4	NR

NR: Not reported.

Table 4: Comparison of mean age (SD) of patients with thyroid cancer.

Study	Mean Age (SD)	Range
Makki 2014–2017 *N* = 166	51 (17)	15–85
El Shallaly *et al.* 2009–2020 *N* = 98	44 (17)	11–80
P-value	0.0014	Highly significant

proportions 50.3% and 49.7%, respectively. Follicular adenoma was the most common benign tumor (98%) (Figure 3).

Thyroid carcinoma was reported in 98 samples. The mean age of patients with thyroid cancer was 44 (SD±17) years. Papillary carcinoma was the commonest malignant tumor (44.9%), followed by follicular carcinoma (28.6%). However, if we consider Hurthle cell tumor (15.3%) as a type of follicular carcinoma, the percentage increases to 43.9%, making Follicular tumor almost as common as papillary tumors. Medullary and anaplastic carcinomas both accounted for 4.1% of patients (Figure 4).

Table 5: Thyroid cancer types.

Study	Follicular %	Hurthle cell ca%	Papillary %	Anaplastic %	Medullary%	Metastatic and Others %
Makki-(Sudan) (2007–2014) *N* = 166	43%	NR	27%	10%	2%	6% Metastatic 5% Sarcoma/lymphoma
Our study (Sudan) (2009–2020) *N* = 98	28.6 %	15.3%	44.9%	4.1%	4.1%	3% Metastatic
Koyuncuire (Turkey) (2006–2014) *N* = 95	4 (4.2%)	16 (16.8%)	70 (73.7%)	NR	1 (1%)	3 (WDT-UMP) +1 (SETTLE)
American Thyroid association (USA)	10–15%	3–5%	70–80%	2%	2%	
Tsegaye (Ethiopia) 1994–1998 *N* = 64	15.6	NR	76.6	6.3	1.5	

NR: not reported; WDT-UMP: well-differentiated tumors of uncertain malignant potential; SETTLE: spindle epithelial tumor with thymus like element.

The mean age of patients with cancer was, with increasing order: papillary 39.5 years (SD±17); range (11-80), follicular 46.1 (±15.2); range (23-75), Hurthle cell 49.2 (±16.1); range (18-70), medullary 54 (±11.8); range 37-63, and anaplastic 57.3 (±11.9); range (50-75).

4. Discussion

Several studies confirmed that iodine deficiency is the major cause of endemic goiter in Sudan [1-4]. Historically, goiter was observed in Sennar since the 19^{th} century [5]. Sudanese studies have shown an increase in the prevalence of goiters in Darfur (Western Sudan) from 57% to 85% over a period of 20 years [1, 2]. Classically goiter is known to be common in areas of Western Sudan due to its far distance from the sea. However, a more recent study by Medani *et al*. showed that the prevalence of goiter is very high in Central Sudan and that iodine deficiency is still prevalent despite long-standing programs for the control of iodine deficiency disorders [2]. Our study showed that goiter has become common in tribes living along the Nile in Northern Sudan and nearer to the sea than previously reported.

The mean age of patients with simple benign disease was (40.5) years. There was an obvious female preponderance. Benign (nonneoplastic) thyroid diseases constituted the majority of patients ranging from 69-87% of patients (Table 2). These findings as

well as thyroid disease patterns were generally in concordance with that reported in countries where iodine deficiency is endemic [6-9] (Table 3).

Our study confirmed that, of all benign thyroid diseases, simple nodular colloid goiter was the commonest pathology (76.6%) dealt with in the surgery. All efforts should; therefore, be made to put in place an integrated national program including health education, primary prevention by adding iodide to diet, early detection, and management. The latter should include providing proper preoperative management including provision of appropriate investigations, proper operative theatre setup, proper training of surgeons, nurses, anesthetists, and quality postoperative care, in order to make surgery safe.

Regarding thyroid neoplasms**,** the mean age of patients with malignant thyroid disease was 44 years (SD±17). There was no statistically significant difference between the ages of those with simple benign thyroid disease and those with malignant disorders. Of real concern, our study showed that thyroid malignancies are significantly (p=0014) occurring in younger patients than reported previously by Makki [10] (Table 3). This finding has also been observed in another Sudanese study by Osman *et al*. [11]. Thyroid cancers in patients younger than 45 years had better prognosis if they were detected early [12]. The cutoff age of 45 years as a prognostic factor has been included in thyroid TNM staging since 1983 [13, 14]. Recently, the American Joint Committee on Cancer (AJCC) has increased the cutoff age to 55 years [15-17].

The finding that papillary carcinoma was the major thyroid malignancy is comparable to global findings. However, the finding that the combination of follicular and Hurthle cell carcinomas are almost as frequent as papillary carcinoma needs some reflection. Hurthle cell carcinoma is considered a variant or subtype of follicular carcinoma. Hurthle cell carcinoma originates from follicular cells and is diagnosed when Hurthle cells constitute more than 75% of cells in follicular cancer [18, 19].

There is an accumulation of strong evidences that iodine deficiency and endemic goiter are predisposing factors in follicular carcinoma [20- 22]. In addition, treatment with iodides in salt has resulted in decreased incidence of follicular cancer in certain parts of the world [23, 24].

There is even a piece of recent molecular evidence that follicular adenoma can develop into follicular carcinoma [25]. This appears to be mimicking the adenoma-carcinoma sequence in large bowel malignancies.

It is not surprising; therefore, to find in an area with iodine deficiency endemic goiter, that follicular (and Hurthle cell) carcinomas are almost of equal proportions to papillary carcinoma. A study from Western Sudan even showed that follicular carcinoma is more frequent than papillary carcinoma, with proportions of 50% and 35.7%, respectively [26].

This finding is in contradistinction to findings in other regions of the globe, such as the USA, Turkey, and Ethiopia where papillary thyroid cancer significantly predominates [27, 6, 7] (Table 5).

In our study, simple nodular (endemic) goiter accounts for 76.6% of all cases and the combination of follicular adenoma and carcinoma accounted for 15%. As these diseases seem to be connected, one could argue that over 90% of thyroid disease could be eliminated by a simple but proper introduction of iodide to the diet of the target population.

5. Conclusions

The study identified the histopathological pattern and geographical distribution of thyroid disease. SMNG was the commonest benign disease. Follicular and Hurtle cell carcinomas combined were almost as frequent as papillary carcinoma, in contradistinction with that reported and globally. Policy makers should make plans for prevention of SMNG and early detection of thyroid neoplasms. Health Education of public and protocols of management of thyroid diseases

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Ethical Considerations

Ethical approval was obtained from Omdurman Islamic University and Omdurman Hospital research and ethics committees. Informed consent was obtained from all participants of the study. In addition, the study does not contain identifying information about participants.

Competing Interests

The authors declare that they have no conflict of interest.

Availability of Data and Material

Anonymous data are available.

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This study was self-funded.

Authors' Contribution

Gamal Eldin Hussein A. El Shallaly: Writing-original draft, methodology, supervision, and validation. Babiker A. B. Ibrahim: Conceptualization, visualization, and reviewing. Modather M. E. Salih: Data collection, investigation, software, and analysis. Mohamed M. I. Elhajahmed: Data collection, investigation, software, and analysis. Mohammed F. E. Mohammed: Data collection, investigation, software, and analysis. Reem O. M. Daffalla: Data curation, investigation, software, and analysis. Ruaa E. H. Yassin: Data curation, investigation, software, and analysis. Rayan M. M. Ahmed: Data curation, investigation, software, and analysis.

All: Review and final approval.

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