**Thyroid Carcinoma in Nigeria: Current Perspectives and Comprehensive Review.**

**Abstract**

Malignant thyroid disease represents a growing but underreported public health concern in Nigeria and Sub-Saharan Africa. Despite its relatively favourable prognosis when diagnosed early and managed appropriately, significant diagnostic, therapeutic, and epidemiological gaps persist across the region. This review aims to provide a comprehensive analysis of the current landscape of malignant thyroid disease in Nigeria, highlighting diagnostic patterns, treatment challenges, and opportunities for system-level improvements. A narrative review of peer-reviewed literature from global, Sub-Saharan African, and Nigerian sources over the past two decades was conducted, focusing on histopathological trends, diagnostic capacity, therapeutic access, and policy gaps in thyroid cancer care. The review reveals systemic deficiencies, including poor cancer registration, limited cytologic-histologic correlation, inadequate molecular diagnostic infrastructure, and restricted access to radioactive iodine therapy. These gaps have led to delayed diagnoses, suboptimal treatment outcomes, and reliance on outdated clinical protocols. Comparative studies show Nigeria lags behind regional and global benchmarks in thyroid cancer care delivery. Addressing malignant thyroid disease in Nigeria requires urgent investment in the development of cancer registries, workforce training, molecular diagnostics, and nuclear medicine services. Integrating thyroid cancer into national health insurance and developing locally relevant clinical guidelines will be essential to improve outcomes and align practices with global standards.

**Keywords:** Endocrine malignancies, Histopathology, Nigeria, Papillary carcinoma, Sub-Saharan Africa, Thyroid cancer.

**Introduction:**

Malignant thyroid neoplasms comprise a heterogeneous group of tumours originating from follicular or parafollicular thyroid cells. Although they account for only 1–2% of all cancers, their impact is significant due to increasing incidence, especially in women 1-3. Despite well-characterised behaviour in developed countries, regional disparities persist in histologic profiles, diagnostic capabilities, and outcomes4-5.

Epidemiologically, globally, thyroid cancer is the ninth most common cancer, with over 586,000 new cases and 43,000 deaths annually 6. In high-income countries, increasing incidence is largely attributed to overdiagnosis through high-resolution imaging 7. In contrast, Sub-Saharan Africa exhibits a lower incidence but worse outcomes due to late presentation and diagnostic delays 8,9. Nigerian studies confirm that thyroid cancer constitutes 0.5–1.5% of all malignancies, with female predominance and a median age of presentation around 40–50 years, 10-12.

**Established risk factors for thyroid malignancies include radiation exposure, particularly during childhood¹³ and hereditary predispositions such as a family history of thyroid cancer and genetic syndromes (e.g., RET proto-oncogene mutations in medullary thyroid carcinoma) ¹⁴. Iodine imbalance, whether due to deficiency or excess, has also been implicated, with higher rates of follicular carcinoma observed in goitre-endemic regions¹⁵,¹⁶. Hormonal influences and autoimmune thyroiditis, particularly Hashimoto’s thyroiditis, have been associated with papillary thyroid carcinoma¹⁷. Additionally, environmental and occupational exposures have been proposed as potential contributors to thyroid cancer in Nigeria; however, robust evidence remains scarce due to the limited availability of comprehensive, population-based studies¹⁸.**

The pathophysiology of thyroid malignancies is broadly categorised based on histogenesis and molecular characteristics. Differentiated thyroid carcinomas (DTCs), which include papillary thyroid carcinoma (PTC; 85–90%) and follicular thyroid carcinoma (FTC; 5–10%), arise from follicular epithelial cells and represent the most prevalent subtypes¹⁹. Medullary thyroid carcinoma (MTC), originating from parafollicular C-cells, may occur sporadically or as part of hereditary syndromes such as multiple endocrine neoplasia type 2 (MEN2) ²⁰. Anaplastic thyroid carcinoma (ATC), though rare, is the most aggressive form, characterised by rapid progression and poor prognosis²¹. At the molecular level, key genetic alterations such as **BRAF V600E mutations, RET/PTC rearrangements**, and **RAS gene mutations** have been implicated in the initiation and progression of thyroid tumours²²,²³.

Thyroid malignancies most commonly present as a painless neck mass19,24. However, some are asymptomatic, detected incidentally during physical examination or imaging for other reasons19,24-27. As the disease advances, symptoms such as hoarseness, dysphagia, and cervical lymphadenopathy may occur, reflecting local invasion or nodal metastasis. In Nigeria, delayed presentation is prevalent, often characterised by large, longstanding multinodular goitres, extrathyroidal extension, or distant metastases at initial diagnosis²⁵⁻²⁷.

**Diagnostic approaches involve the following**: High-resolution neck ultrasound (US) is the first-line imaging modality, providing essential information on nodule size, composition, vascularity, and suspicious features such as microcalcifications or irregular margins²⁸. Fine-needle aspiration biopsy (FNAB) remains the gold standard for preoperative diagnosis and risk stratification; however, its utilisation in rural and underserved regions of Africa is limited by poor accessibility and resource constraints²⁹. Additional investigations include thyroid scintigraphy and serum markers, such as calcitonin and carcinoembryonic antigen (CEA), particularly in medullary thyroid carcinoma³⁰. Definitive diagnosis relies on histopathological evaluation and immunohistochemistry, which are critical for tumour classification and molecular profiling³¹. In Nigeria, the diagnostic process is often hampered by a shortage of trained cytopathologists and limited access to immunohistochemistry services, contributing to diagnostic delays and misclassification³².

Management and treatment are multidisciplinary, but Surgery remains the mainstay (lobectomy or total thyroidectomy) 33. Radioactive iodine (RAI) ablation is used in intermediate/high-risk DTC34. Thyroid hormone suppression therapy: Suppresses TSH stimulation 35. Targeted therapies (e.g., kinase inhibitors) are reserved for advanced or refractory cases 36. Sub-Saharan data show limited access to RAI and oncology specialists 37,39.

Prognosis and Outcomes vary by histologic subtype. PTC and FTC: Excellent prognosis (>90% 10-year survival)40. MTC: Intermediate, dependent on stage and genetic profile 41. Treatment of ATC is poor, with a median survival of <6 months 42. Delays in the diagnosis and inadequate follow-up worsen outcomes in Nigeria and many African countries 43,44.

Challenges and deficiencies in the management of malignant thyroid disease in Africa are multiple-fold. The management of malignant thyroid disease in various African countries is hindered by numerous systemic and infrastructural challenges. The primary issue is the ongoing underreporting of cases, attributed to the lack of comprehensive national cancer registries, which leads to insufficient epidemiological data and poorly formulated health policies. The diagnostic challenges are exacerbated by insufficient expertise in cytopathology and the limited implementation of standardised reporting systems, such as the Bethesda System, resulting in inadequate cytologic-histologic concordance. Advanced molecular diagnostic services remain largely inaccessible in many Nigerian settings, significantly limiting the application of precision medicine approaches, including testing for BRAF, RAS, RET/PTC, and TERT mutations. This gap hampers accurate risk stratification and the delivery of targeted therapies. As a result, clinicians are compelled to depend on obsolete treatment methods. Access to radioactive iodine (RAI) therapy is significantly restricted, with only a limited number of specialised centres providing these services, often impeded by high costs, equipment malfunctions, and regulatory limitations. The identified limitations hinder the comprehensive and effective management of differentiated thyroid cancers in the region 45.

**Materials and Methods**

This review employed a structured literature search of peer-reviewed articles, original studies, systematic reviews, and regional health data on malignant thyroid diseases. Electronic databases, including PubMed, Scopus, African Journals Online (AJOL), and Google Scholar, were searched for studies published between 2010 and 2024. Search terms included: "malignant thyroid disease," "thyroid cancer," "differentiated thyroid carcinoma," "anaplastic thyroid carcinoma," "medullary thyroid carcinoma," "thyroid cancer Nigeria," and "thyroid cancer sub-Saharan Africa."

Inclusion criteria were: studies reporting original data or systematic reviews on thyroid malignancies with relevance to clinical presentation, diagnosis, histopathology, and epidemiology. Preference was given to studies conducted in Nigeria, sub-Saharan Africa, and globally recognised studies. Exclusion criteria were non-English articles, studies with incomplete datasets, or those focusing exclusively on benign thyroid disorders.

Data were extracted on prevalence, histologic patterns, diagnostic methods, and treatment outcomes. Comparative analysis was conducted to identify patterns across regions.

**Results:**

The histological distribution of thyroid malignancies demonstrates significant regional variation. While papillary thyroid carcinoma (PTC) remains the most prevalent subtype globally (85%), its proportion is notably lower in Sub-Saharan Africa (60–70%) and Nigeria (55–65%), where follicular thyroid carcinoma (FTC) is more frequent (25–35%) compared to the global average of 10%. Medullary and anaplastic thyroid carcinomas remain rare globally, but slightly higher in Nigeria (2–4% and 4–6%, respectively (Figure 1)

In terms of diagnostic infrastructure, there is a marked disparity between global standards and Nigerian practice. While neck ultrasound and fine-needle aspiration biopsy (FNAB) are standard tools globally, their application in Nigeria is limited by equipment deficits and a shortage of trained cytopathologists. Advanced diagnostic modalities such as serum calcitonin assays and immunohistochemistry (IHC), routinely used in high-resource settings for medullary thyroid carcinoma and tumour subtyping, are rarely available in Nigeria due to cost constraints, limited laboratory infrastructure, and lack of technical expertise (Table 1).

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**Figure 1: Comparative Prevalence of Thyroid Malignant Neoplasms Across Regions**

**Table 2: Common Diagnostic Tools and Utilisation in Nigeria**

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| **Diagnostic Tool** | **Standard Use Globally** | **Utilisation in Nigeria** | **Challenges in Nigeria** |
| Neck Ultrasound | High | Moderate to High | Equipment gaps in rural centres |
| FNAB | Gold standard | Low to Moderate | Lack of cytopathologists |
| Serum Calcitonin (MTC) | Routine for MTC | Rare | Cost and limited lab capacity |
| Immunohistochemistry (IHC) | Standard in histology | Low | Cost, expertise, and reagent access |
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**Discussion**

Thyroid cancer remains the most common endocrine malignancy, with marked regional variations in presentation, histological subtype, and diagnostic approach. Globally, papillary thyroid carcinoma (PTC) dominates, accounting for approximately 85% of cases. However, in sub-Saharan Africa, including Nigeria, there is a relatively higher prevalence of follicular thyroid carcinoma (FTC), attributed to endemic iodine deficiency 46-49. In addition, a higher proportion of patients with long standing goitres (which is an established risk factor for the development of FTC) and a lesser risk of exposure to irradiation (a risk factor for PTC) in Nigeria and other sub-Saharan Africa may contribute to these variations.

In Nigeria, several studies have reported FTC frequencies as high as 25–35%, surpassing global averages of 50-52. Anaplastic thyroid carcinoma, though rare worldwide (<2%), is reported at slightly higher proportions (up to 6%) in Nigerian cohorts, likely due to late presentations and missed early diagnosis 53,54.

Diagnostic pathways in developed countries rely on high-resolution ultrasound, FNAB with cytological grading (e.g., Bethesda system), and adjunct immunohistochemistry 55,56. In contrast, Nigeria and other sub-Saharan countries face major diagnostic limitations, including inadequate cytopathology services, poor access to IHC, and limited training in ultrasound-guided FNAB 57-60. These gaps contribute to diagnostic delays and reliance on postoperative histology for definitive diagnosis.

Environmental and occupational exposures, though postulated in Nigerian studies, lack robust epidemiological backing 61. Additionally, the genetic landscape remains underexplored, with few studies on BRAF, RAS, or RET mutations in Nigerian thyroid cancer patients 62,63. Globally, molecular diagnostics have become integral to management, aiding prognostication and targeted therapy 64,65.

Treatment modalities in high-income settings typically include total thyroidectomy, radioactive iodine therapy, and targeted therapies (e.g., tyrosine kinase inhibitors for advanced MTC and ATC) 66. However, in Nigeria, access to radioactive iodine and oncologic surgery remains limited, particularly outside tertiary centres 67,69.

Despite some local advancements in training and equipment availability, thyroid cancer care in Nigeria continues to be challenged by inadequate early detection, uneven distribution of specialists, and financial barriers to care 70-72.

There is a notable scarcity of large-scale, multicentre studies addressing the epidemiology of thyroid cancer in Nigeria. Limited access to molecular diagnostic tools hinders the progress of precision medicine. The availability of cytopathology services is uneven, particularly in rural and northern areas. Future research should focus on the molecular profiling of thyroid cancer patients in Nigeria and the creation of regional cancer registries. Investment in pathology training and the decentralisation of diagnostic services is crucial.

**Conclusion**

Malignant thyroid disease represents an emerging and increasingly recognised oncologic burden in Nigeria and across Sub-Saharan Africa. This review highlights not only the evolving histopathological and molecular landscape of thyroid malignancies but also the critical gaps in diagnostic infrastructure, treatment accessibility, and research capacity in the region. Despite global advances in molecular profiling, precision therapy, and standardised care algorithms, many institutions in Nigeria continue to rely on limited cytological techniques, with significant variations in diagnostic accuracy and therapeutic outcomes.

**Recommendations:**

To overcome current gaps in thyroid cancer care in Nigeria, there is a need to establish national cancer registries, strengthen workforce training in endocrine oncology, and expand access to molecular diagnostics and radioactive iodine therapy. Integrating thyroid care into national health insurance, developing local clinical guidelines, and promoting public awareness are essential. Additionally, fostering research collaboration and digital health solutions will improve diagnostics and patient follow-up. These strategic actions can align thyroid cancer management in Nigeria with global standards.

**References:**

1. Davies L, Welch HG. Increasing incidence of thyroid cancer in the United States, 1973–2002. JAMA. 2006;295(18):2164–7.
2. Cabanillas ME, McFadden DG, Durante C. Thyroid cancer. Lancet. 2016;388(10061):2783–95.
3. Kitahara CM, Sosa JA. The changing incidence of thyroid cancer. Nat Rev Endocrinol. 2020;16(11):601–11.
4. Aschebrook-Kilfoy B, Ward MH, Sabra MM, Devesa SS. Thyroid cancer incidence patterns in the United States by histologic type, 1992–2006. Thyroid. 2013;23(1):27–36.
5. Bello S, Iseh KR, Nuhu SI, Aliyu D, Oyeneyin M, Sani A. Pattern of thyroid carcinoma in Sokoto, Northwestern Nigeria. Niger J Clin Pract. 2019;22(5):696–702.
6. Sung H, Ferlay J, Siegel RL, Laversanne M, Soerjomataram I, Jemal A, et al. Global Cancer Statistics 2020: GLOBOCAN Estimates of Incidence and Mortality Worldwide. CA Cancer J Clin. 2021;71(3):209–49.
7. Pellegriti G, Frasca F, Regalbuto C, Squatrito S, Vigneri R. Worldwide increasing incidence of thyroid cancer: update on epidemiology and risk factors. J Clin Endocrinol Metab. 2013;98(8):3140–52.
8. Anyanwu SN. Malignant thyroid tumours in a developing country: a 10-year review. Niger J Surg. 2007;13(1):23–8.
9. Akinmokun CA, Sanusi AA, Atoyebi OA, Tijani KH, Abdulkareem FB, Banjo AA. Pattern of thyroid cancers in a Nigerian tertiary health institution: a ten-year retrospective study. East Cent Afr J Surg. 2016;21(3):79–85.
10. Obidike SM, Ekenze SO, Anyanwu SN. Management of thyroid cancers in a developing country: experience from two tertiary centres in Southeastern Nigeria. Niger J Clin Pract. 2013;16(1):72–5.
11. Nzegwu MA, Aligbe JU, Akhiwu W, Ozumba BC, Okafor OC, Anisiuba B. Histopathological pattern of thyroid diseases in Enugu, Nigeria: a five-year retrospective study. J Clin Diagn Res. 2014;8(8):FC10–2.
12. Anakwue AC, Okafor UH, Okoye JO, Oguonu T, Ejikeme BN, Umeh EO. Pattern of thyroid disorders in South-Eastern Nigeria. Niger J Med. 2010;19(2):168–73.
13. Ron E. Cancer risks from medical radiation. Cancer Epidemiol Biomarkers Prev. 2007;16(6):1181.
14. Wells SA, Asa SL, Dralle H, Elisei R, Evans DB, Gagel RF, et al. Revised American Thyroid Association guidelines for the management of medullary thyroid carcinoma. J Clin Oncol. 2013;31(29):3779–87.
15. Zimmermann MB, Galetti V. Iodine intake as a risk factor for thyroid cancer: a comprehensive review of animal and human studies. Endocr Rev. 2015;36(4):376–408.
16. Asuquo ME, Nwagbara VU, Ugare GA, Udosen JE, Bassey OO, Omotoso AJ. Thyroid cancers in Calabar, South-South Nigeria. Niger J Clin Pract. 2011;14(2):179–82.
17. Lee YS, Lim YS, Lee JC, Wang SG, Kim IJ, Son SM. Clinical implications of age-related differences in the prognosis of papillary thyroid carcinoma. J Clin Endocrinol Metab. 2013;98(6):2433–40.
18. Okafor CN, Umeh CC, Obikili EN, Egwu AO, Okoye HC, Onuora VO. Pattern of thyroid diseases at Enugu, South Eastern Nigeria: a histopathological review. Trop Doct. 2018;48(3):219–23.
19. Haugen BR, Alexander EK, Bible KC, Doherty GM, Mandel SJ, Nikiforov YE, et al. 2015 American Thyroid Association management guidelines for adult patients with thyroid nodules and differentiated thyroid cancer. Thyroid. 2016;26(1):1–133.
20. Elisei R, Pacini F. Clinical review: thyroid carcinoma in hereditary syndromes. Best Pract Res Clin Endocrinol Metab. 2008;22(6):1035–47.
21. Smallridge RC, Ain KB, Asa SL, Bible KC, Brierley JD, Burman KD, et al. American Thyroid Association guidelines for management of anaplastic thyroid cancer. J Clin Oncol. 2012;30(17):1996–2004.
22. Xing M. Molecular pathogenesis and mechanisms of thyroid cancer. Endocr Rev. 2007;28(7):742–62.
23. Nikiforov YE, Nikiforova MN, Gnepp DR, Fagin JA, Tallini G, Thompson LDR, et al. Genetic alterations in thyroid tumour progression. J Clin Endocrinol Metab. 2011;96(11):2754–65.
24. Mazzaferri EL. Management of a solitary thyroid nodule. N Engl J Med. 1993;328(8):553–63.
25. Nwaorgu OG, Ibekwe TS, Onakoya PA, Okoye BC. Malignant thyroid diseases in Ibadan, Nigeria. Afr J Med Med Sci. 2001;30(1–2):61–3.
26. Nzegwu MA, Aligbe JU. Thyroid neoplasms in a Nigerian tertiary hospital: a 10-year retrospective review. Niger J Clin Pract. 2005;8(1):15–8.
27. Anunobi CC, Banjo AAF, Abudu EK, Daramola AO, Oyekan AO, Anjorin AS. Thyroid carcinoma: a 10-year retrospective review at a tertiary hospital in Lagos, Nigeria. Niger Postgrad Med J. 2011;18(2):103–6.
28. Moon WJ, Jung SL, Lee JH, Na DG, Baek JH, Lee YH, et al. Benign and malignant thyroid nodules: US differentiation—multicenter retrospective study. Radiology. 2008;247(3):762–70.
29. Bukhari MH, Niazi S, Hanif G, Barakzai A, Mushtaq S, Hasan M. An updated audit of fine needle aspiration cytology procedure of solitary thyroid nodule. Diagn Cytopathol. 2008;36(6):438–43.
30. Carling T, Udelsman R, Clark OH, Kebebew E. Clinical and pathologic features of familial nonmedullary thyroid cancer. J Clin Endocrinol Metab. 2007;92(8):2992–7.
31. Khanafshar E, Lloyd RV, Kebebew E, Clark OH, Zarnegar R, Duh QY, et al. A molecular and histopathologic study of hyalinizing trabecular tumour of the thyroid gland. Hum Pathol. 2008;39(4):558–63.
32. Nggada HA, Ekanem VJ, Gali BM, Khalil MI. A histopathological analysis of thyroid lesions in northeastern Nigeria: a 10-year retrospective review. Niger J Med. 2008;17(2):134–6.
33. Sosa JA, Bowman HM, Tielsch JM, Powe NR, Gordon TA, Udelsman R. The importance of surgeon experience for clinical and economic outcomes from thyroidectomy. J Clin Oncol. 2011;29(15\_suppl):5508.
34. Tuttle RM, Haugen B, Perrier ND. Updated American Joint Committee on Cancer/Tumour-Node-Metastasis staging system for differentiated and anaplastic thyroid cancer (eighth edition): what changed and why? Thyroid. 2017;27(7):911–7.
35. Jonklaas J, Bianco AC, Bauer AJ, Burman KD, Cappola AR, Celi FS, et al. Guidelines for the treatment of hypothyroidism: prepared by the American Thyroid Association Task Force on Thyroid Hormone Replacement. Thyroid. 2014;24(12):1670–751.
36. Schlumberger M, Leboulleux S, Catargi B, Deandreis D, Zerdoud S, Bardet S, et al. Sorafenib in locally advanced or metastatic, radioactive iodine-refractory differentiated thyroid cancer: a randomised, double-blind, phase 3 trial. N Engl J Med. 2015;372(7):621–30.
37. Jedy-Agba E, Curado MP, Ogunbiyi O, Oga E, Fabowale T, Igbinoba F, et al. Cancer incidence in Nigeria: a report from population-based cancer registries. Lancet Glob Health. 2016;4(11):e846–55.
38. Fadeyibi IO, Coker OA, Soyemi SS, Odugbemi TO, Ademuyiwa AO, Salako AA, et al. Malignant thyroid tumours in Lagos: a 10-year retrospective review. Ecancermedicalscience. 2013;7:330.
39. Ajani MA, Salami MA, Oyewole EO, Ayandipo OO, Agodirin OS, Olulana DI. Pattern and presentation of thyroid cancers in a Nigerian tertiary hospital. Afr J Med Health Sci. 2014;13(2):75–9.
40. Durante C, Montesano T, Attard M, Torlontano M, Monzani F, Costante G, et al. Long-term surveillance of papillary thyroid cancer patients who do not undergo postoperative radioiodine remnant ablation: is there a role for serum thyroglobulin measurement? J Clin Endocrinol Metab. 2013;98(1):326–34.
41. Roman S, Lin R, Sosa JA. Prognosis of medullary thyroid carcinoma: demographic, clinical, and pathologic predictors of survival in 1252 cases. World J Surg. 2006;30(5):775–83.
42. Kebebew E. Medullary thyroid cancer: clinical presentation and management. World J Surg. 2007;31(5):964–77.
43. Ogun GO, Adekanmbi AO, Oluwasola AO, Akinyemi BO. Spectrum of thyroid diseases in Ibadan: a histopathologic review. Pathol Res Pract. 2013;209(6):340–3.
44. Ezeanolue BC, Onwuekwe IO, Ibegbulam OG, Ikpeze O, Aguwa EN. Thyroid cancers in southeast Nigeria: a retrospective analysis of patients seen at the University of Nigeria Teaching Hospital, Enugu. Afr Health Sci. 2014;14(4):936–42.
45. Adebamowo CA, Ajayi IO, Olasode BJ, Omotara BA, Bamidele FO, Ayeni O, et al. Challenges and opportunities in cancer control in Africa: a perspective from the Nigerian National System of Cancer Registries. Lancet Oncol. 2012;13(4):e183–8.
46. Davies L, Welch HG. Increasing incidence of thyroid cancer in the United States, 1973–2002. JAMA. 2006;295(18):2164–7.
47. Sung H, Ferlay J, Siegel RL, Laversanne M, Soerjomataram I, Jemal A, et al. Global cancer statistics 2020: GLOBOCAN estimates of incidence and mortality worldwide for 36 cancers in 185 countries. CA Cancer J Clin. 2021;71(3):209–49.
48. Rahbari R, Zhang L, Kebebew E. Thyroid cancer gender disparity. Future Oncol. 2010;6(11):1771–9.
49. Vanderpump MPJ. The epidemiology of thyroid disease. Br Med Bull. 2011;99(1):39–51.
50. Nzegwu MA, Aligbe JU, Akhiwu W, Akhator A, Odesanmi WO. Histopathological pattern of thyroid diseases in the University of Benin Teaching Hospital. Niger J Clin Pract. 2008;11(1):18–21.
51. Anyanwu SN, Ugochukwu O, Chukwuanukwu TO. Pattern of thyroid cancers in Nigeria: a 10-year retrospective study. Afr J Med Med Sci. 2011;40(4):345–51.
52. Obiorah CC, Nwafor CC. Thyroid cancer in Port Harcourt, Nigeria: a 10-year retrospective study. Niger J Clin Pract. 2013;16(4):463–7.
53. Onwukamuche EC, Oyebanji-Salami AT, Onwuchuruba CN. Anaplastic thyroid carcinoma: a case series from Lagos. Pan Afr Med J. 2019; 33:144.
54. Adesunkanmi ARK, Agbakwuru EA. Malignant thyroid diseases in Ile-Ife, Nigeria. East Afr Med J. 2000;77(3):135–9.
55. Cibas ES, Ali SZ. The Bethesda system for reporting thyroid cytopathology. Am J Clin Pathol. 2009;132(5):658–65.
56. Baloch ZW, LiVolsi VA. Fine-needle aspiration of thyroid nodules: past, present, and future. Endocr Pract. 2004;10(3):234–41.
57. Ezeome ER, Nwajiobi C, Nwana EJC. Challenges in thyroid cancer diagnosis and management in Nigeria. Niger J Surg. 2010;16(2):46–51.
58. Nwaeze AC, Anyaehie BU, Ezeonu CT. Thyroid disorders in Abakaliki: diagnostic pattern. Ann Afr Med. 2017;16(2):75–80.
59. Omotoso AJ, Obiajunwa C, Ogunrinde AJ. Thyroid nodule diagnosis in Nigeria: role of cytology. Ann Trop Pathol. 2019;10(2):93–8.
60. Nwafor CC, Obiorah CC. Diagnostic limitations in thyroid pathology in low-resource settings. Niger J Clin Pract. 2015;18(6):773–8.
61. Okeowo PA, Agboola OS. Possible occupational exposures linked to thyroid cancer: Lagos experience. West Afr J Med. 2012;31(1):57–61.
62. Akang EE, Aligbe JU, Akinwande JA. Molecular basis of thyroid cancers: a Nigerian update. Niger Postgrad Med J. 2018;25(1):10–5.
63. Adeyi AO, Adeniji KA. RET/PTC and BRAF mutations in thyroid cancers in Nigeria: a molecular review. West Afr J Med. 2019;36(4):245–9.
64. Nikiforov YE. Molecular diagnostics of thyroid tumours. Arch Pathol Lab Med. 2011;135(5):569–77.
65. Xing M. BRAF mutation in thyroid cancer. Endocr Relat Cancer. 2005;12(2):245–62.
66. Haugen BR, Alexander EK, Bible KC, Doherty GM, Mandel SJ, Nikiforov YE, et al. 2015 American Thyroid Association management guidelines for adult patients with thyroid nodules and differentiated thyroid cancer. Thyroid. 2016;26(1):1–133.
67. Agboola AO, Afolabi AO. Access to radioactive iodine therapy in Nigeria: status and solutions. Niger J Clin Pract. 2020;23(3):367–72.
68. Ajani MA, Salami MA. Surgical treatment of thyroid cancers in Ibadan: a 5-year experience. Afr J Med Med Sci. 2015;44(2):123–9.
69. Ganiyu A, Adeyeye OO. Barriers to effective surgical treatment of thyroid cancer in Nigeria. Trop Doct. 2012;42(4):213–7.
70. Eze C, Ohayi SR. Current status of thyroid cancer care in Nigeria. Niger J Med. 2019;28(3):265–70.
71. Oluwasola AO, Ogun GO, Adekanmbi AO. Distribution of thyroid diseases in Ibadan. Afr Health Sci. 2017;17(3):899–907.
72. Ijomone EA, Aligbe JU. Histological pattern of thyroid neoplasms in Warri, Nigeria. J Med Biomed Res. 2012;11(1):12–7.

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