

Investigation of different types of carcinomas among differentiated thyroid cancer patients managed in the Department of Nuclear Medicine at Dr George Mukhari Academic Hospital, South Africa: A five year retrospective study

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RESEARCH

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ABSTRACT

Background

Differentiated thyroid cancers (DTC) are abnormal tissues growing around the thyroid gland manifesting in various forms, they vary according to geographic locations and life style. Knowledge of different types of DTC is important in order to implement cost effective treatment strategies.

Aims

This study was aimed at establishing the types of thyroid cancers among DTC patients managed with radioiodine post-surgery in the Department of Nuclear Medicine at Dr George Mukhari Academic Hospital (DGMAH) in South Africa.

Methods

A retrospective five year (2007–2013) review of patient files managed post-surgery in the Nuclear Medicine Department for various thyroid diseases. A total of 51 patient files were

examined. Males and females who received at least a single treatment dose of radioiodine (I-131) qualified for the study thus excluding 26 patients treated for grave's disease and 9 DTC patients who did not receive a dose of radioiodine. A pie chart was used for categorical variables of the subtypes of carcinomas.

Results

The follicular carcinoma was the leading malignancy: 8 /16; (50 per cent); followed by the papillary carcinomas amounting to 6/16; (37.5 per cent); only one patient was managed for the Hurtle cell carcinoma; 1/16 (6.25 per cent) and also one patient for poorly differentiated follicular carcinoma, 1/16; (6.25 per cent).

Conclusion

Follicular carcinoma was found to be the most common type of DTC managed at DGMAH followed by papillary carcinoma. However, the Hurtle cell carcinoma and the poorly differentiated follicular carcinomas were found to be rare.

Key Words

Differentiated thyroid carcinomas, malignancy, radioiodine

What this study adds:

1. What is known about this subject?

Papillary carcinoma is the most common type of DTC followed by follicular carcinoma. The poorly differentiated and the Hurthle cell carcinomas are rare types of carcinomas.

2. What new information is offered in this study?

In South Africa the most common type of DTC is follicular followed by papillary, other subtypes are rare. The types of DTC cancers depend on the region of study thus environmental and dietary factors influence the prevalence of a particular type of DTC.

3. What are the implications for research, policy, or practice?

There is need to investigate the levels of iodine in the diets of people in the regions serviced by DGMAH since, literature associates the occurrence of follicular carcinoma to iodine deficiency, most likely iodine should be supplemented in the diet of this population.

Background

The most common endocrine malignancies are the differentiated thyroid carcinomas (DTC),^{1,2} accounting to 1 per cent of all of all malignancies and almost 0.5 per cent of all cancer related deaths.^{3,4} However, DTC has good prognosis,^{1,4,5} depending on whether is adequately administered.⁵

The subtypes of differentiated thyroid cancers include the papillary,^{6,7} follicular,⁶⁻⁸ anaplastic,⁸ the Hurthle cell, the poorly differentiated insular carcinomas,⁹ and the medullary carcinoma.⁴ The papillary and the follicular carcinomas are the most prevalent amounting to over 70 per cent of all thyroid cancers.⁸ The papillary cancer metastasis to the cervical lymph node resulting in high recurrence rates. However, that does not translate to high mortality.^{3,8} The follicular carcinomas account to about 9 per cent of all cancers.⁴ Females are more affected by papillary cancer than males.^{3,4,5} The peak incidence of papillary cancer is 30–40 years compared to a peak of 35–45 years for the follicular carcinoma.³

It has since been established that the prognosis of papillary carcinoma is better than follicular carcinoma. However, in cases where the papillary carcinoma is associated with tall cells and columnar cells, poor prognosis has been documented. Furthermore, poor prognosis of papillary carcinoma has also been linked to the degree of cellular and vascular invasion. On the other hand poor prognosis of follicular carcinoma has been associated with 'widely invasive and vascular invasion features.'¹⁰

The anaplastic thyroid carcinoma has been reported to have fatal outcomes,⁴ however, it is the least common type.⁸ The Hurthle cell carcinoma is a rare subtype which has been found to be more aggressive compared to follicular thyroid carcinoma and has the worst prognosis.¹¹ The poorly differentiated follicular carcinoma is also rare.¹²

The risk factors are not well understood. However, the general risks factors for developing thyroid carcinomas have been cited as being female, being older, having at one point undergone radiation therapy for head and neck tumours.⁹

Exposure to radiation has also been cited as a risk factor of increased incidences of thyroid cancer in addition to nuclear fallout incidences. A typical example being the Chernobyl accident which resulted in increased thyroid cancers among children.¹³

The prognostic factors of DTC include old age, histological type and family history.⁸ The histological and environmental factors also play a major role.¹² The follicular carcinoma predominates in regions characterised by iodine deficiency whereas the papillary carcinoma pre-dominates among populations where iodine is replete.^{12,14}

Baltaci et al.,¹⁴ reported on a study by Kucharzews-ki et al., who established that tissues of thyroid cancer patients had low levels of zinc. The latter is a tracer element which is needed for optimal activity thyroid hormones as well many other hormones. Wade and King,¹⁵ reported that the activity of the enzyme 1.5'-deiodinase is dependent of the optimal levels of zinc in the serum. The enzyme is responsible for conversion of thyroxine (T₄) into triiodothyronine (T₃). Zinc is therefore a micro food linked with thyroid hormones.¹⁵

The first line of treatment is surgery for all DTC,^{1,4,6,16} followed by radioiodine ablation. However, in Japan, radioiodine ablation is only recommended for high risk cases.¹⁷ However, the extent of surgery excision remains controversial.⁶ The thyroid disorders vary according to geographic locations. Knowledge of the types of DTC is important in order to implement cost effective and effective treatment strategies. This study therefore seeks to establish the different types of thyroid cancers among DTC patients managed at DGMAH.

Methods

A retrospective five year (2007–2013) review of patients managed post-surgery in the Nuclear Medicine Department for various thyroid diseases. A total of 51 patient files were examined. Males and females who received at least a single treatment dose of radioiodine qualified for the study thus excluding 26 patients treated for grave's disease and 9 DTC patients who did not receive a dose of radioiodine. Sixteen DTC patients who suffered from papillary, follicular, poorly insular differentiated follicular and the Hurthle cell carcinomas were selected for this study.

Pie charts were used to depict categorical variables of the types of carcinomas. The study was approved by the Medunsa Research and Ethics Committees in compliance with the Helsinki Declaration. The clearance number issued

was MREC/M/68/2014. Codes were assigned to each patient data in order to maintain confidentiality.

Results

Of the 51 patient files reviewed, only 16 matched the selection criteria (DTC patients who received at least one dose of radioiodine). The range of DTC patients was from 39–69 years. The male to female ratio was 1:7.

Figure 1 shows the histological pattern of DTC types of carcinomas. Follicular carcinoma was found to be the most common of type DTC (8 patients) followed by papillary (6 patients). The Hurthle cell and poorly differentiated carcinomas were the least frequent, (1 patient each). All the patients were indigenous South Africans from provinces surrounding DGMAH, formerly Ga-Rankwa Hospital. This hospital services mainly indigenous South Africans owing to the apartheid legacy. The male to female ratio of the DTC patients was found to be 1:7.

Discussion

In this study, the types of DTC managed over 5 years in the Department of Nuclear Medicine at DGMAH are presented. A predominance of female patients was observed for all the types of DTC patients. Of the 16 DTC patients 14/16 (87.5 per cent) were females compared to 2/16 (12.5 per cent) males. The male to female ratio was found to be 1:7. Previously studies also established a similar pattern.^{4,6,18}

Among the types of DTC malignancies managed at DGMAH between 2007 and 2013, the follicular carcinoma was the most common type accounting to 8/16; (50 per cent). These findings are in agreement with other findings from similar geographical conditions.¹⁹⁻²¹ A study by Decker,¹⁹ in 1974 established that follicular carcinoma was prevalent in Johannesburg. Another study years later (2001) by Malaudzhi et al.,¹⁸ also concluded that the follicular type of DTC was the most common type among indigenous South Africans treated at Durban King George VIII hospital. This pattern was seen among DGMAH patients who were also predominantly from the indigenous South African population, hence the opinion that among indigenous South African population, follicular carcinoma predominates. Malaudzhi et al.,¹⁸ also established that follicular carcinoma was more prevalent among the indigenous South Africans compared to the Indian population in South Africa. The latter were found to be more susceptible to papillary carcinoma. The differences between the two groups may be attributed to diet and lifestyle.²⁰

A study by Kalk et al.,²⁰ of DTC patients among indigenous South Africans also established that follicular carcinoma was the most common type. It is therefore not a coincidence that follicular carcinoma was found to be the most common among the DTC patients managed at DGMAH who were also of indigenous origin.

The morphology of thyroid cancers in any given population is influenced by the nutritional iodine status.²² Malak et al.,²³ established that in South Africa there is iodine dietary deficiency among indigenous people. This should explain why follicular carcinomas were found to be the most common type among DTC patients managed at DGMAH who are predominantly from the indigenous groupings. Studies by Malaudzhi et al.,¹⁸ and Kalk et al.,²⁰ also established that follicular carcinomas predominate among indigenous populations where iodine is deficient whereas the papillary carcinomas are associated with iodine-replete populations.

In contrast to findings of this study, other studies in different regions that established papillary carcinomas are the most prevalent type of DTC,^{3-6,8} we found it to be the second most common type of malignancy amounting to 6/16; (37.5 per cent). These findings were contrary to other studies that established papillary carcinoma to be the most prevalent type of carcinoma. These differences can be explained from findings by Ilias et al.,¹² that confirmed that environmental factors play a significant role in the pathogenesis and histology of DTC. The predominance of follicular carcinomas among indigenous South Africans is therefore most likely due to iodine deficiency in their diet. All DTC patients in this study were from Limpopo province. Limpopo province is far from the sea and the iodine among the population is presumably low hence the justification of follicular carcinoma being the most common type. An investigation of iodine in the diet of these people could be of significant importance to the planners.

The study further established that one patient, 1/16 (6.25 per cent) was managed for the Hurthle cell thyroid carcinoma (HCTC) from 2007–2013, a confirmation that this malignancy was indeed rare. Previously studies also established similar findings.^{11,23-26} The World Health Organization (WHO) viewed HCTC as an oxyphilic variant of the follicular thyroid carcinoma.²⁵ However, Ganly et al.,²⁴ in 2013 after performing genomic dissection of the HCTC tumour revealed that this malignancy is unique from both the papillary and the follicular carcinomas.

The patient diagnosed with HCTC in this study was an elderly female aged 69 years. This finding concurs with a previous study by Petric et al.,¹¹ who found that in addition to being rare, the HCTC affects mainly adult females. Among the 108 HCTC patients treated in their institute from 1971–2011, 82 were females while in this study of the 14 female DTC patients managed from 2007–2013 at DGMAH, only one of them was diagnosed with HCTC. These findings testify that Hurthle cell carcinoma is a rare malignancy prevalent among female elderly patients, as previously found in literature.^{11,24,26,27} Lastly, the study also established the presence of the poorly insular differentiated thyroid carcinoma (PDTC) to be uncommon, only one female patient, 1/16 (6.25 per cent) was diagnosed with this type of carcinoma. Cherkaoui et al.,²⁷ also found PDTC to be an uncommon malignancy among the DTC patients. In this study, the PDTC patient was found to be a female aged 48 years. A study Cherkaoui et al.,²⁷ also established that the disease in addition to being rare was also prevalent among the elderly women, the mean age at presentation was established to be 50 years.

Conclusion

Follicular carcinoma was found to be the most common type of DTC managed at DGMAH followed by papillary carcinoma. The third spot were occupied by the Hurthle cell and the poorly differentiated carcinomas (one patient for each), rare malignancies common among the female elderly patients.

References

- Middendorp M, Grunwald F. Update on recent developments in the therapy of differentiated thyroid cancer. *Semin Nucl Med.* 2010;40:145–152.
- Shi R, Qu N, Liao T, et al. The trend of age-group effect on prognosis in differentiated thyroid cancer. *Sci Rep.* 2016;6:270–286.
- Teoh CM, Rohaiza M, Chan KY, et al. Pre-ablation diagnostic whole-body scan following total thyroidectomy for well-differentiated thyroid cancer: is it necessary? *Asian J Surg.* 2005;28(2):90–96.
- Anand SS, Sood V, Kumar PG, et al. Retrospective analysis of thyroid cancer patients. *MJAF.* 2008;64:07–10.
- Alonso MPG, Breton MAB, Correa CP, et al. Iodine uptake in the chest in the follow up of well-differentiated thyroid cancer. *Rev Esp Nucl.* 2011;20(1):24–28.
- Harmer CL, McCready VR. Thyroid cancer: differentiated carcinoma. *Cancer Treat Rev.* 1996;22:161–177.
- Mittendorf EA, Wang X, Perrier ND, et al. Followup of patients with papillary thyroid cancer: in search of the optimal algorithm. *J Am Coll Sur.* 2007;2007:239–247.
- Ravishankar U, Pande S, Savita N. I-131 in the management of differentiated thyroid cancer – an update on current recommendations and practices. *Apollo Medicine.* 2009;6(4):347–354.
- Herbst MC. The role of I-131 post surgery. *CANSA.* 2006;1–13.
- British Thyroid Association Guidelines for the Management of Thyroid Cancer. *Clinical Endocrinology.* 3rd Edition. Welly Black. 2014.
- Petric R, Gazic B, Besic N. Prognostic factors for disease-specific survival in 108 patients with Hurthle cell carcinoma: a single-institution experience. *BMC Cancer.* 2014;14:777.
- Ilias I, Alevizaki M, Lakka-Papadodima E, et al. Differentiated thyroid cancer in Greece: 1963-2000. Relation to demographic and environmental factors. *Hormones (Athens).* 2002;1(3):174–178.
- Perros P, Colley S, Boelaert K, et al. British Thyroid Association Guidelines for the Management of Thyroid Cancer. Wiley Blackwell. 3rd Edition. 2014.
- Baltaci AK, Mogulkoc R, Belviranli M. Serum levels of calcium, selenium, magnesium, phosphorus, chromium, copper and iron--their relation to zinc in rats with induced hypothyroidism. *Acta Clin Croat* 2013;52(2):151–156.
- Wade L, King JC. Effect of low zinc intakes on basal metabolic rate, thyroid hormones and protein utilization in adult men. *J Nutr.* 1986;16:1045–53.
- Teoh CM, Rohaiza M, Chan KY, et al. Pre-ablation diagnostic whole-body scan following total thyroidectomy for well-differentiated thyroid cancer: is it necessary? *Asian J Surg.* 2005;28(2):90–96.
- Wang C, Crapo LM. The epidemiology of thyroid diseases and implications for screening. *Endocrinol Metab Clin North.* 1997;26(1):189–218.
- Mulaudzhi TV, Ramadial PK, Madika TE, et al. Thyroid carcinoma at King Edward VIII hospital, Durban, SA. *East Afr J.* 2001;78(5):242–245.
- Decker GAG. Carcinoma of the thyroid at Baragwanath Hospital. *S Afr J Sur.* 1974;12:135–158.
- Kalk WJ, Sitas F, Petterson AC. Thyroid Cancer in South Africa-An indicator of regional iodine deficiency. *S Afr Med J.* 1997;87(6):735–738.
- Der EM, Quayson SE, Clegg-Lampthey JN, et al. Thyroid Disorders in Accra, Ghana: A Retrospective histopathological Study at the Korle-Bu Teaching Hospital. *JMBS.* 2013;2(1):1–7.

22. Malak T, Mathewos B, Enawgaw B, et al. Prevalence and types of thyroid malignancies among thyroid enlarged patients in Gondar, Northwest Ethiopia: a three years institution based retrospective study. *BMC Cancer*. 2014;14:899.
23. DeLellis RA, Lloyd RV, Heitz PU, et al, editors. *World Health Organization Classification of Tumors: Pathology and Genetics of Tumours of Endocrine Organs*, (Lyon: IARC Press). 2004;73–76.
24. Ganly I, Ricarte J, Eng S, et al. Genomic dissection of Hurtle carcinoma reveals a unit of class of thyroid malignancy. *J Clin Endocrinol Metab*. 2013;98(5):E-962–E972.
25. Hurthle Cell Thyroid Tumor. [Internet]. 2017 [cited 2017 Mar 24]. Available from: <https://www.endocrineweb.com/conditions/thyroid-cancer/hurthle-cell-thyroid-tumor>.
26. Cherkaoui GS, Guensi A, Taleb S, et al. Poorly differentiated thyroid carcinoma: a retrospective clinicopathological study. *Pan Afr Med J*. 2015;21:137.
27. Pacini F, Castagna MG, Brilli L, et al. Thyroid cancer: ESMO clinical practice guidelines for diagnosis, treatment and follow up. *Ann Oncol*. 2012;23(7):1110–119.

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PEER REVIEW

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CONFLICTS OF INTEREST

The authors declare that they have no competing interests.

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ETHICS COMMITTEE APPROVAL

The study was approved by Medunsa Campus of the University of Limpopo research committees, clearance number: MREC/M/68/2014: PG.

Figure 1: Types of DTC malignancies diagnosed among patients managed from 2007–2013 in the DNM at DGMAH

