Disparities in the Initial Presentation of Differentiated Thyroid Cancer in a Large Public Hospital and Adjoining University Teaching Hospital

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Background: Healthcare disparities associated with insurance and socioeconomic status have been well characterized for several malignancies, such as lung cancer. To assess whether there are healthcare disparities in thyroid cancer, this study evaluated the stage on initial presentation of patients with differentiated thyroid cancer (DTC) in a public versus university teaching hospital.

Methods: A retrospective chart review was performed to identify patients with a new diagnosis of DTC from January 1, 2007, to January 1, 2010, in a large public and adjoining university teaching hospital at a single academic medical center. Medical records were reviewed for demographics, pathology, and American Joint Committee on Cancer tumor–node–metastasis stage at initial presentation.

Results: There were 49 cases of well-DTC (96% papillary and 4% Hürthle) in the public hospital and 370 cases (95% papillary, 2% Hürthle, and 3% follicular) in the university teaching hospital. Median age (years) at presentation was 50 in the public versus 48 in the university teaching hospital ($p=0.39$). Ninety-six percent of public hospital patients were from ethnic minorities compared with 16% of university teaching hospital patients ($p<0.0001$). Only 1 (2%) public hospital patient had private insurance compared with 85% of university teaching hospital patients. Tumor status ($p=0.002$) and stage ($p=0.03$) were more advanced and extrathyroidal extension ($p=0.02$) was more prevalent among public hospital patients compared with university teaching hospital patients. In a multivariable analysis, public hospital, male gender, increasing age, advanced tumor status, and the presence of lymphovascular invasion were the best predictors of more advanced disease stage. Public hospital patients were 3.4 times more likely to present with advanced DTC than university teaching hospital patients of the same age, gender, tumor status, and lymphovascular invasion status (95% confidence interval 1.29–8.95).

Conclusions: In a public hospital, where the patient population is defined primarily by insurance status, patients were more likely to present with advanced-stage DTC than patients presenting to an adjacent university teaching hospital. These results suggest a disparity in the stage on initial presentation of DTC, possibly resulting in a delayed diagnosis of cancer.

Introduction

DIFFERENTIATED THYROID CANCER (DTC), including papillary and follicular carcinomas, represents the majority of thyroid cancers (1). Known risk factors for DTC include radiation exposure to the head and neck and a family history of thyroid cancer (1). Most patients with DTC, however, have no known risk factors, and screening for thyroid cancer in the general population is not recommended. Patients with DTC often do not manifest any signs or symptoms. DTC is usually first noted as a lump in the neck by the patient or their phy-

sician, or is discovered incidentally on unrelated imaging of the neck (2).

The prognosis for DTC is excellent, with 10-year survival rates exceeding 90% (1). Factors associated with a poor prognosis for patients with DTC include advanced stage (increased tumor size, extrathyroidal extension, and distant metastases), age greater than 45 years, an incomplete surgical resection, and aggressive histologic subtypes such as tall cell, columnar, or insular variants (1,3). The association between cervical lymph node metastases and mortality remains controversial. However, the presence of cervical

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lymph node metastases is associated with an increased rate of recurrence (4).

The incidence of papillary thyroid carcinoma has tripled over the past 30 years (5) and is thought to be due in part to increased incidental detection of small tumors on imaging (6). More recent epidemiologic studies, however, have discovered an increase in DTC tumors of all sizes, suggestive of a true rise in thyroid cancer incidence (7,8). More advanced DTC, presenting with extrathyroidal extension and cervical metastases, has also increased in incidence (5).

Disparities in stage of presentation associated with insurance, ethnicity, and socioeconomic status have been described for other malignancies such as breast, lung, and colorectal cancers (9,10). However, disparities in the stage at initial presentation have not been examined in patients with DTC. The overall rates of thyroid cancer are highest among non-Hispanic Whites, followed by Asian/Pacific Islanders, Hispanics, Blacks, and American Indian/Alaskan Natives (11). Using Surveillance, Epidemiology and End Results (SEER) data from 1992 to 2004, Yu *et al.* found disproportionate increase in incidence of thyroid cancer among certain ancestral origin and ethnic groups in the United States (12). The largest increase in incidence was seen in Blacks, followed by non-Hispanic Whites, Hispanics, and Asians (12). Another SEER study by Enewold *et al.* from 1980 to 2005 found that thyroid cancer incidence rates increased the most among non-Hispanic Whites and Black women, compared with Hispanics, Black men, and Asian-Pacific Islanders (13).

The National Association of Public Hospitals represent only 2% of the United States' acute-care hospitals, but they provide 25% of the nation's uncompensated care. New York City is the home of the nation's largest public hospital system, the Health and Hospitals Corporation (HHC), of which the public hospital in this study is a member (14). The medical safety net for uninsured or underinsured New Yorkers (14), HHC, does not limit registration of uninsured patients at any of its sites (15). In this study's public hospital outpatient clinics, one-third of patients are uninsured while 48% are covered by public insurance, and 87% come from ancestral

origin and ethnic minority groups (Table 1). In many ways, the public hospital, in both New York City and the nation, serves as a proxy for ethnicity, socioeconomic status, and, ultimately, access to care. Anticipating significant ethnic and socioeconomic differences between patients with DTC at a university teaching and public hospital, we hypothesized that patients in a large public hospital present with more advanced DTC than those in an adjoining university teaching hospital.

Materials and Methods

Patients

Under a New York University Institutional Review Board–approved protocol, all patients presenting with a new diagnosis of thyroid cancer (ICD-9 diagnosis code 193.0), treated with surgery from January 2007 to January 2010, were identified in a large public hospital (New York City HHC, Bellevue Hospital Center). During the same time period, patients with a new diagnosis of thyroid cancer, treated with surgery by New York University Endocrine Surgery Associates, were identified in an adjoining university teaching hospital (New York University Langone Medical Center).

Patients with poorly differentiated, anaplastic, and medullary thyroid carcinoma were excluded. Seven patients presented with more than one distinct histologic type of DTC. Pathology from these patients was categorized based on the tumor with the most advanced characteristics, including tumor size, extrathyroidal extension, angiolymphatic invasion, and lymph node metastases. Operative and pathology reports were analyzed for tumor size, histology, extrathyroidal extension, and lymphovascular invasion. The presence of cervical lymph node and/or distant metastases at initial presentation was also recorded. All tumor pathology was read by a single pathology department that is shared by both hospitals.

Medical records were reviewed for demographics including age, gender, self-reported ethnicity (Caucasian, Black, Hispanic, Asian, and Other), insurance status (Medicare, Medicaid, private, uninsured), and hospital type (public, university teaching).

Setting

The university teaching and public hospitals in this study are both part of a single academic medical center. Access to each hospital via public and private transportation is identical, as the hospitals are adjacent, equidistant from public transportation, and have equivalent parking options. All patients in each hospital presented to the Division of Endocrine Surgery with a required scheduled appointment. The Division of Endocrine Surgery is comprised of the same surgeons at both hospitals and holds similar outpatient office hours at regularly scheduled times on a weekly basis.

Pathology

Tumors were staged using the 2002 American Joint Committee on Cancer tumor–node–metastasis staging system (16). Pathology submitted with nodes that were found to have no disease involvement was classified as “N0,” whereas pathology submitted without lymph nodes available for analysis was classified as “NX.” Distant metastasis was assessed as absent (M0 or MX) or present (M1). DTC stage was characterized as early (stages I and II) or advanced (stages III and IV).

TABLE 1. ETHNICITY AND INSURANCE
IN A NEW YORK PUBLIC HOSPITAL

	Number of outpatients from 2007 to 2010 (n=335,055) n (%)
Ethnicity	
Hispanic	152,497 (46)
Black	59,937 (18)
Asian	47,393 (14)
Caucasian	42,228 (13)
Other	33,000 (10)
Insurance	
Medicaid	129,736 (39)
Uninsured	109,579 (33)
Commercial	40,220 (12)
Medicare	30,942 (9)
Other	24,578 (7)

Issued by the New York City Health and Hospitals Corporation's Office of Corporate Planning Services, and made available by Bellevue Hospital Center's Office of Grant Management. Percentages may not total 100% due to rounding.

Statistical analysis

Comparisons of demographic and clinical characteristics between the two hospital groups were performed using Chi-square tests and Fisher's exact tests for categorical variables and Wilcoxon nonparametric tests for continuous variables. Multiple logistic regression models to examine stage in relation to patient's characteristics were created using SAS 9.2. Models were selected using stepwise procedures with differences in the likelihood ratio test statistics as the criteria for model selection.

Results

Patient demographics

There were 49 patients newly diagnosed with DTC in the public hospital and 370 patients in the university teaching hospital over the 3-year study period (Table 2). There were no differences between patients in the two hospitals with respect to gender and age. Patients in the university teaching hospital were predominantly Caucasian (84%) while 96% of public hospital patients were self-reported of other ethnicities ($p < 0.0001$). Only one public hospital patient had private insurance, compared with 85% of patients in the university teaching hospital ($p < 0.0001$).

Pathology

Forty patients (11%) in the university teaching hospital and four (8%) in the public hospital underwent thyroid lobectomy alone (p value = 0.61). The remaining patients were treated with total thyroidectomy, with or without lymph node dissection. Twenty-nine patients (59%) from the public hospital and 261 (71%) patients from the university teaching hospital

had lymph nodes available for analysis. Forty-seven patients (96%) in the public hospital and 351 (95%) in the university teaching hospital had papillary thyroid carcinoma (Table 3). Similar proportions of DTC histological subtypes were seen at each hospital ($p = 0.47$). Tumor status ($p = 0.002$) and stage ($p = 0.03$) were more advanced in the public hospital patients. Extrathyroidal extension was more prevalent among public hospital patients ($p = 0.02$), whereas lymphovascular invasion ($p = 0.02$) was less present. There was no difference between hospitals with respect to nodal involvement and tumor size.

In a univariable analysis (Table 4), patient demographics and disease characteristics were compared by early stage (stages I and II) versus advanced stage (stages III and IV). Hospital type ($p = 0.01$), age ($p < 0.0001$), tumor and nodal status ($p < 0.0001$), extrathyroidal extension ($p < 0.0001$), and

TABLE 3. TUMOR HISTOPATHOLOGY AND STAGING

	n (%)		p value
	Public hospital (n = 49)	University teaching hospital (n = 370)	
Histological type			
Papillary	47 (96)	351 (95)	0.47 ^a
Classical	31 (63)	236 (64)	
Follicular	13 (27)	95 (26)	
Tall cell	2 (4)	8 (2)	
Oncocytic	1 (2)	11 (3)	
Diffuse sclerosing	0	1 (0.3)	0.002 ^a
Follicular	0	10 (3)	
Hürthle cell	2 (4)	9 (2)	
T			
1	27 (56)	230 (62)	0.002 ^a
2	4 (8)	67 (18)	
3	16 (33)	73 (20)	
4	2 (4)	0	
N			
X	20 (41)	109 (29)	0.08 ^b
0	11 (22)	154 (42)	
1a	14 (29)	86 (23)	
1b	4 (8)	21 (6)	
M			
X, 0	47 (96)	365 (99)	0.19 ^a
1	2 (4)	5 (1)	
Stage			
1	29 (59)	254 (69)	0.03 ^b
2	2 (4)	43 (12)	
3	16 (33)	60 (16)	
4	2 (4)	13 (4)	
Extrathyroidal extension			
Present	15 (31)	63 (17)	0.02 ^b
Absent	34 (69)	307 (83)	
Lymphovascular invasion			
Present	8 (17)	125 (34)	0.02 ^b
Absent	38 (83)	245 (66)	
Indeterminate	3		
Tumor size			
Median	1.5	1.3	0.27 ^c
Range	0.2–10.2	0.1–11.0	

Percentages may not total 100% due to rounding.

^aFisher's exact test.

^bChi-square test.

^cWilcoxon nonparametric test.

TABLE 2. PATIENT DEMOGRAPHICS

	n (%)		p value
	Public hospital (n = 49)	University teaching hospital (n = 370)	
Gender			
Male	7 (14)	93 (25)	0.09 ^a
Female	42 (86)	277 (75)	
Age			
Median	50	48	0.39 ^b
Range	24–70	11–86	
Ethnicity			
Caucasian	2 (4)	311 (84)	<0.0001 ^c
Asian	22 (45)	12 (3)	
Hispanic	18 (37)	8 (2)	
Black	3 (6)	5 (1)	
Other	4 (8)	34 (9)	
Insurance			
Government program	23 (47)	55 (15)	<0.0001 ^a
Medicaid	20 (41)	4 (1)	
Medicare	3 (6)	51 (14)	
Private	1 (2)	314 (85)	
Uninsured	25 (51)	1 (0.3)	

^aChi-square test.

^bWilcoxon nonparametric test.

^cFisher's exact test.

TABLE 4. PATIENT AND TUMOR CHARACTERISTICS BY EARLY VERSUS ADVANCED STAGE

	n (%)		p value
	Stage 1, 2 (n = 328)	Stage 3, 4 (n = 91)	
Hospital			
University teaching	297 (91)	73 (80)	0.01 ^a
Public	31 (9)	18 (20)	
Gender			
Male	72 (22)	28 (31)	0.08 ^a
Female	256 (78)	63 (69)	
Age			
Median	46	57	<0.0001 ^b
Range	11–85	24–86	
Ethnicity			
Caucasian	243 (74)	70 (77)	0.14 ^a
Asian	27 (8)	7 (8)	
Hispanic	17 (5)	9 (10)	
Black	6 (2)	2 (2)	
Other	35 (11)	3 (3)	
Insurance			
Government program	50 (15)	28 (31)	0.002 ^a
Medicaid	12 (4)	12 (13)	
Medicare	38 (12)	16 (18)	
Private	259 (79)	56 (62)	
Uninsured	19 (6)	7 (8)	
Histological type			
Papillary	313 (95)	85 (94)	0.59 ^c
Classical variant	206 (63)	61 (67)	
Follicular variant	92 (28)	16 (18)	
Tall cell variant	3 (1)	7 (8)	
Oncocytic variant	11 (3)	1 (1)	
Diffuse sclerosing	1 (0.3)	0	
Follicular	7 (2)	3 (3)	
Hürthle cell	8 (2)	3 (3)	
T			
1	232 (71)	25 (27)	<0.0001 ^a
2	66 (20)	5 (5)	
3	29 (9)	60 (66)	
4	1 (0.3)	1 (1)	
N			
X	119 (36)	10 (11)	<0.0001 ^a
0	146 (45)	19 (21)	
1a	53 (16)	47 (52)	
1b	10 (3)	15 (16)	
M			
X,0	324 (99)	88 (97)	0.18 ^c
1	4 (1)	3 (3)	
Extrathyroidal extension			
Present	26 (8)	52 (57)	<0.0001 ^a
Absent	302 (92)	39 (43)	
Lymphovascular invasion			
Present	75 (23)	58 (64)	<0.0001 ^a
Absent	251 (77)	32 (36)	
Indeterminate	2	1	
Tumor size			
Median	1.2	1.8	<0.0001 ^b
Range	0.1–6.0	0.5–11.0	

^aChi-square test.^bWilcoxon nonparametric test.^cFisher's exact test.

TABLE 5. MULTIPLE LOGISTIC REGRESSION MODEL FOR EARLY VERSUS ADVANCED DIFFERENTIATED THYROID CANCER

	Odds ratio	95% confidence interval
Hospital		
University teaching	3.4	1.29–8.95
Public	1	
Gender		
Male	0.44	0.22–0.91
Female	1	
Age (years)		
<50	12.45	5.36–28.92
≥50	1	
T		
1, 2	24.71	10.67–57.18
3, 4	1	
Lymphovascular invasion		
Absent	4.37	2.13–8.97
Present	1	

lymphovascular invasion ($p < 0.0001$) were significantly different between early and advanced-stage DTC patients. In a multivariable analysis, public hospital type, male gender, increasing age, advanced tumor status, and the presence of lymphovascular invasion were the best predictors of more advanced disease (Table 5). Specifically, public hospital patients were 3.4 times more likely to present with advanced DTC than university teaching hospital patients of the same age, gender, tumor status, and lymphovascular invasion status (95% confidence interval 1.29–8.95).

Discussion

In a large public versus university teaching hospital, where the patient populations are defined primarily by ethnicity and insurance status, we found a statistically significant difference in DTC stage at initial presentation. There were a greater proportion of tumors with extrathyroidal extension in the public hospital. There was no significant difference in tumor size or presence of distant metastases between patients in the two hospitals. Distant metastases are rare in DTC and it would be difficult to make conclusions on metastatic disease in a small sample size over a short period of time. Multivariable analysis adjusting for age, gender, tumor, and lymphovascular invasion also showed significantly increased odds of presenting with advanced DTC in the public hospital compared with the university teaching hospital.

Certain features of the two hospitals allowed for optimal study of healthcare disparities between the two patient populations. The two hospitals are part of a single academic institution, with the same medical faculty. It is therefore unlikely that individual physician behavior and approach to patient care contributed in a significant way to the disparate stage of presentation demonstrated here. All patients in both hospitals were referred by other physicians, such as primary care physicians or medical endocrinologists, and had scheduled appointments with the Division of Endocrine Surgery. It is likely that fewer of the public hospital patients have access to a primary care physician, as 7 out of 10 uninsured adult New Yorkers do not have access to regular physician visits

(17). In this study, however, information on access to referring physicians and the healthcare system overall was not examined. Most of the public hospital patients were uninsured. However, fewer than 40% of HHC sites require payment before services, and all HHC sites are willing to see any uninsured patient and offer sliding fee discounts (15). Additional studies are underway to examine potential barriers to healthcare access, as well as delays in diagnosis and surgical treatment among patients in the public hospital.

A single pathology department staffs both hospitals, minimizing variation and interobserver discrepancies in pathologic tumor staging and classification. Distance from a hospital has been associated with late-stage presentation of other malignancies such as melanoma (18). Separated by three city blocks in the same urban area, the hospitals' close proximity minimizes geographic location as a factor in the disparity observed in stage of DTC on initial presentation. Access via public transportation to the two hospitals is identical as they are adjoining.

Age and gender are known to be strongly associated with the stage on presentation of thyroid cancer (1). Univariable analysis in our study confirmed that patients presenting with advanced stage DTC were significantly older than patients presenting with early stage cancer. Age and gender, however, did not differ significantly between the two hospital groups. Despite their close proximity, the two hospitals serve very distinct groups of patients. Patients in the university teaching hospital were primarily Caucasians with private insurance, while patients in the public hospital were largely from ancestral origin and ethnic minority groups with Medicaid or no insurance. Previous studies have shown that uninsured or Medicaid-insured patients with breast, colon, or lung cancer are more likely to present with advanced disease at the time of diagnosis (9,10). The results of this study demonstrate similar findings for DTC. Since many thyroid cancers are asymptomatic, discovered on physical exam or unrelated imaging studies, uninsured or inadequately insured patients who do not have regular access to healthcare are potentially less likely to have their cancer detected at an early stage. While no previous studies have focused specifically on disparities in the stage of DTC at initial presentation, ethnic origin has been associated with poorer clinical outcomes after thyroidectomy (19), especially among patients with limited access to high-volume surgeons.

Limitations of this study include a small sample size and relatively short study period. Mortality and recurrence data were not examined in this limited 3-year study and therefore, overall outcomes for patients with advanced disease were not analyzed. There were fewer patients overall in the public hospital ($n=49$) than in the university teaching hospital ($n=370$). Despite this discrepancy, and despite the fact that the majority of patients with thyroid cancer initially present at an early stage, the relatively small group of patients in the public hospital was more than three times as likely to present with advanced thyroid cancer after multivariate analysis.

These results highlight a disparity in the initial presenting stage of DTC among patients in a public versus university teaching hospital. Hospital type was found to be one of the strongest predictors of advanced tumor stage. Bilimoria *et al.* identified a discrepancy in the treatment of thyroid cancer patients related to hospital type and insurance status. They demonstrated that patients with thyroid cancer in community

and lower volume hospitals were less likely to be treated with total thyroidectomy than patients in academic and higher volume hospitals (20). Bilimoria did not focus on the stage or extent of thyroid cancer at presentation. In addition, because their data were obtained from a national database, additional factors such as different surgeons in the multiple hospitals add confounding variables not present in our study. In our study, with the same high volume surgeons in each hospital, the majority of patients were treated with total thyroidectomy, with no significant difference in total thyroidectomy rates between the two hospitals.

Analysis of the patient populations at each hospital revealed two very different groups with respect to insurance and ethnicity, which suggests that these two factors may be related to the differences observed in presenting tumor stage. More specifically, uninsured and underinsured patients in the public hospital may experience barriers to healthcare access that result in a delayed diagnosis of DTC. It is not clear whether certain minority and ethnic groups experience an increased incidence of DTC due to under diagnosis, environmental factors, or different tumor biology. Future studies may reveal that certain ethnic and minority groups are more susceptible to thyroid cancer and unique tumor biology or molecular markers maybe identified within individual groups.

Yu *et al.* found that the annual percentage change in the incidence of thyroid cancer was significantly different among non-Hispanic Whites, Blacks, Hispanic Whites, and Asians (12). The same group also found that Filipinos had significantly higher incidence than the other major Asian groups (12). Other studies have found Filipinos to be at increased risk for thyroid cancer and recurrence relative to other ethnic groups (21). In a matched pair analysis, Clark *et al.* found Filipino patients with thyroid nodules to be at significantly increased risk of thyroid cancer, despite benign cytologic findings (22). Patients born in the Philippines were found to be at increased risk of thyroid cancer compared with Filipinos born in the United States (23). No definitive explanation has been found for this observation, although environmental influences such as an iodine-rich diet and the proximity of volcanoes are leading theories (23,24). While our study included only one Filipino patient in the public hospital group, Yu *et al.* also found that among Asians, Chinese patients had the second highest incidence of thyroid cancer, a group that comprised nearly half of our public hospital patients (12). Further studies on these and other specific ethnic subgroups are clearly indicated.

Radiation exposure is the strongest known environmental risk factor for thyroid cancer, and future investigations should focus on whether certain minority groups are exposed to higher radiation levels at home or at work. In this study, patients are unlikely to have a difference in radiation exposure, as they all live within the New York City metropolitan area. Some patients, however, may have emigrated from other countries where radiation exposure may have been higher.

Additional research is needed to identify specific obstacles to healthcare access among specific ancestral origin and ethnic groups. The increasing incidence of DTC, especially among ethnic and socioeconomic groups that already experience delays in diagnosis of other malignancies such as breast and cervical cancers (25), emphasizes the importance of timely diagnosis and treatment to prevent late-stage disease and

poor outcomes in these populations. As the incidence of thyroid cancer continues to rise, studies to identify obstacles to early detection will be important to provide appropriate treatment in all clinical settings.

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