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Papillary Thyroid Microcarcinoma: Decision-Making, Extent of Surgery, and Outcomes

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Abstract

Background—The optimal extent of surgery for patients with papillary thyroid microcarcinoma (PTMC), tumors ≤ 1 cm, is controversial, because survival is excellent regardless of approach. The objective of this study was to investigate patient and surgeon decision making about the extent of surgery for PTMC.

Materials and Methods—We conducted a retrospective review of thyroid cancer patients operated on at a single institution from 2008–2016. To examine decision-making about the extent of surgery, we performed a discourse analysis on all available documentation looking for patient or surgeon reasons.

Results—Of the 853 thyroid cancer patients, 125 (14.7%) had a PTMC as their largest tumor. Overall, 27.2% of the PTMC patients underwent a thyroid lobectomy (TL), while 72.8% had a total thyroidectomy (TT). Of those patients diagnosed with PTMC preoperatively (19/125), a significantly higher proportion underwent a TT (94.7% vs. 68.9%, $p=0.02$). In all cases, documentation indicated that these preoperatively diagnosed patients followed the surgeon's recommendation regarding the extent of surgery. Reasons surgeons cited for recommending a TT included patient and disease factors (34.6%), belief that TT was the standard treatment (21.7%), ease of follow-up (8.7%), and referring provider preference (4.3%). Of the 19 patients diagnosed preoperatively, 4 (21.1%) patients had a complication, one (5.3%) of which was permanent and potentially avoidable with less extensive surgery.

Conclusions—These data suggest that surgeons drive decision making about the extent of thyroidectomy in patients with preoperatively diagnosed PTMC. With recent guidelines recommending TL, closer examination of decision-making is needed to ensure that patients make well-informed, preference-based decisions.

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Study design, data analysis and interpretation done by A.K.P and S.C.P. Data collection and manuscript draft done by A.K.P. Review of manuscript done by R.W.R, D.F.S, R.S.S and S.C.P.

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Keywords

papillary thyroid microcarcinoma; decision-making

Introduction

Thyroid cancer is the fastest growing malignancy in the United States with approximately 65,000 new cases diagnosed each year (1). Over the past 35 years, the incidence of papillary thyroid cancer (PTC) tripled, largely due to an increase in the incidence of papillary thyroid microcarcinoma (PTMC)(2). These small cancers that measure 1 cm or less, account for approximately 50% of the rise in PTC incidence (3). Many cases of PTMC are incidental findings on postoperative pathology, and the proportion diagnosed preoperatively is unclear due to the lack of this variable in population-based datasets. Despite the dramatic rise in incidence, the mortality rate of patients with PTC has remains stable at approximately 0.5 per 100,000 people (2). In addition, autopsy studies demonstrate that PTMC is a common finding with a reported prevalence as high as 36% (4). Furthermore, estimates show that approximately 17 million Americans unknowingly have PTMCs that are not clinically relevant (5). Taken together, the stable mortality rate and high proportion of people discovered to have PTMC on autopsy suggest that many of the new cases of PTMC reflect subclinical disease.

The optimal treatment strategy for patients with PTMC has long been debated amongst endocrinologists and surgeons. An analysis of the Surveillance, Epidemiology and End Results (SEER) database from 1998 – 2010 demonstrated that 98.6% of PTMC patients in the United States undergo surgery, and 73.4% have a total thyroidectomy (TT) (6). However, the proportion of these patients who had PTMC diagnosed prior to surgery is unknown. While most patients in the past underwent surgical treatment, and had the option between TT and TL, recent changes in the American Thyroid Association (ATA) guidelines now recommend TL as the optimal treatment for patients with PTMC that lack features that would indicate removal of the contralateral lobe, such as nodal metastasis or a family history of thyroid cancer. The ATA guidelines also added a less aggressive approach, active surveillance with serial ultrasounds, as an alternative management strategy akin to that used for low risk prostate cancer patients (7, 8). Furthermore, the ATA guidelines acknowledge the importance of patient preference in the decision-making process and emphasize the need to “minimize treatment-related morbidity and unnecessary therapy” (8, 9). Potential treatment-related morbidities in patients with PTMC who undergo TT include the requirement for lifelong thyroid hormone replacement and an increased risk for permanent complications, such a hypoparathyroidism and voice changes, that can impair quality of life (6, 10, 11).

Currently, data are lacking on why patients and surgeons chose TT over TL prior to the recent ATA guideline changes. Because of concern that TT represents overtreatment of PTMC, it is necessary to understand why these decisions were made in order to facilitate a shift towards less aggressive treatment and implementation of the updated guidelines. Published studies examining decision-making for PTMC are limited to physician surveys

that do not assess how decisions are made in actual clinical practice (12, 13). Because the rate of PTMC diagnosis continues to increase, we need to understand how treatment decisions are made so that we can develop strategies to ensure patients are informed of their treatment options and make decisions that are aligned with their preferences and values. Therefore, the goal of this study was to further investigate clinical decisions about the extent of surgery for PTMC and how these decisions affect long-term outcomes.

Material and Methods

We conducted a retrospective review of all thyroid cancer patients (ages 5 to 78) in a prospectively maintained database who were operated on at the University of Wisconsin (UW) by 9 different surgeons between January 2008 to May 2016. Patients were included if their largest tumor was a PTMC, they had no other thyroid malignancy, and their surgery was performed at a UW Health hospital. We examined information on demographics, timing and method of diagnosis, cytology, type of procedure, final pathology, complications, recurrence and survival. For those with a PTMC diagnosed prior to surgery, we used discourse analysis to examine decision-making about the extent of thyroidectomy in surgical consult, history and physical, operative and postoperative documentation and categorized into *patient* and *surgeon reasons*. We chose 2008 as the start date for this study to ensure that data on decision-making was available from documentation in the electronic medical record (EMR), which was implemented throughout UW Health in that year. This study was approved by the UW Institutional Review Board at the University of Wisconsin. Because the investigation was exempt from human subject research requirements, informed consent was not obtained from patients or providers.

Patients were defined as having a preoperative diagnosis of PTMC if they had a fine needle aspiration (FNA) that was positive for PTC prior to surgery. These patients were compared to the rest of the patients in the cohort who had PTMC diagnosed incidentally on final pathology following thyroidectomy for benign disease, such as a symptomatic multinodular goiter or an indeterminate thyroid nodule (ITN), defined as meeting Bethesda Criteria 3–5 (14). During all but the last 5 months of the study period, the 2009 ATA guidelines were available to guide decision-making about the extent of surgery. These guidelines indicated that TT and TL were both acceptable treatments and did not include active surveillance. In terms of biopsying thyroid nodules, these guidelines stated that FNA was appropriate for all nodules measuring 1 cm or greater and for nodules that measured 1 cm or less if the nodules had suspicious features on ultrasound (7).

Decision-making about the extent of surgery was examined in adult patients, 18 years of age or older (n=19), who were diagnosed preoperatively with PTMC. The reasons for the extent of surgery were also assessed for adult patients diagnosed with PTMC on final pathology after undergoing a TL (n=32). The decision examined in the TL patients was about whether or not to undergo a completion thyroidectomy (TL+CT) or no further surgery (TL only). One pediatric patient was excluded from the analysis, because their decision-making was done by a surrogate.

To assess decision-making, we identified and reviewed all documentation in the EMR that included any discussion about the extent of thyroidectomy or available surgical options. We evaluated the content of each section of text and classified the documentation into either a *patient reason* or a *surgeon reason* for the treatment decision. Next, we reviewed each reason and further categorized them by theme. To ensure reliability of this process, two authors (AKP and SCP) reviewed all of the documentation and discussed each case until consensus was reached about the content, meaning, and appropriate categorization. For *patient reasons* or preferences, the classification “surgeon’s recommendation” indicated that the patient chose or underwent the procedure because the surgeon recommended it as the appropriate therapy. We categorized *surgeon reasons* into the following eight categories: (1) the procedure was believed to be the “standard treatment”; (2) the patient had “multifocal disease”, (3) “metastatic disease”, or (4) the “nodule size” was large; (5) the patient’s “past [medical or family] history” or (6) “other thyroid diagnosis” was important; (7) TT facilitated the “ease of follow up”; or (8) the “referring provider’s preference” dictated treatment. The categorized *patient* and *surgeon reasons* were mutually exclusive. For example, “We did discuss that the treatment for this is a total thyroidectomy.... [The patient] was in agreement with this plan, “ was categorized as a “surgeon recommendation” for the *patient reason* and “standard treatment” for the *surgeon reason*. Additional examples of how documentation was classified are included in the results. We previously utilized a similar technique to examine written language, called discourse analysis, for evaluating documentation in the EMR (15).

In addition to assessing decision-making, we analyzed the following outcomes—complications, recurrence, and survival. Complications of interest were transient and permanent hypocalcemia and hoarseness. Transient hypocalcemia was defined as an immediate postoperative parathyroid hormone level (PTH) of less than 10 pg/ml and/or the patient receiving a prescription for calcitriol. Permanent hypocalcemia was considered to be present if the patient required calcium to prevent symptoms of low calcium levels greater than 6 months after surgery. Permanent hoarseness was defined as significant voice changes that persisted more than 6 months post-surgery.

Data analysis was performed using SPSS statistical software. Fisher’s exact or Chi-square were used to compare categorical variables. Student’s t-test was used to compare continuous variables, which are presented as mean $\pm$ standard deviation throughout this manuscript. For analysis of *patient* and *surgeon reasons* for the extent of thyroidectomy, the frequency of each reason was calculated by dividing the number of times that reason was documented by the total number of documented reasons for the group being examined. We used the total number of documented reasons for the denominator as opposed to the total number of patients in the group, because some patients had more than one reason documented, and we were unable to reliably determine which reason was the most important.

Results

Overall Cohort

Of the 853 thyroid cancer patients identified, 125 (14.7%) had a PTMC as their largest tumor. The mean age of the cohort was 50.1 ($\pm$ 14.6) years, and 85.6% (n=107) of the

patients were female (Table 1). The average tumor size for the group was 0.51 ($\pm$ 0.3) cm, which includes tumors diagnosed both pre- and postoperatively. Overall, 72.8% (n=91) of the patients underwent TT, while 27.2% (n=34) underwent TL. The average follow-up time for the cohort was 25.5 ($\pm$ 18.7) months, with no significant difference between TL and TT patients (p=0.11).

Preoperative Diagnosis of PTMC

Of the 125 patients with PTMC, 19 (15.2%) were diagnosed preoperatively by fine needle aspiration (FNA). These preoperatively diagnosed patients had their nodules discovered incidentally on imaging in 47.4% of cases. Examination of patient characteristics demonstrated that the patients with a preoperative diagnosis of PTMC were similar to the rest of the cohort with respect to age, gender, ethnicity, family history of thyroid cancer and history of radiation exposure (Table 1). However, patients diagnosed with PTMC preoperatively were significantly more likely to undergo a TT than patients who did not have a known diagnosis of PTMC prior to surgery (94.7% vs 68.9%, p= 0.02) (Table 1). On final pathology, patients with preoperatively diagnosed PTMC also had a larger mean tumor size compared to the rest of the cohort, 0.8 ($\pm$ 0.2) cm vs. 0.47 ($\pm$ 0.3) cm (p=0.0001). In addition, preoperatively diagnosed patients had a significantly higher proportion of classic PTC than those diagnosed incidentally (94.7% vs. 51.9%, p=0.0003) (Table 1).

Preoperative Diagnosis of ITN

In addition to the 19 patients diagnosed with PTMC prior to surgery, the cohort included 50 patients with indeterminate cytology on their preoperative FNA. These patients were similar to the preoperatively diagnosed PTMC patients in all aspects except the extent of surgery planned and the tumor size on final pathology. Patients with an ITN were significantly more likely to undergo a TL than those diagnosed with PTMC prior to surgery (40.0% vs 5.3%, p=0.007). In addition, the ITN patients had significantly smaller tumor sizes when compared to the PTMC patients, 0.51 ($\pm$ 0.3) cm and 0.8 ($\pm$ 0.2) cm (p=0.0002). For the 50 patients with ITNs, the average size of the biopsied nodule on preoperative ultrasound was 2.1 cm, and 86% were greater than 1 cm, indicated that the many of PTMCs diagnosed postoperatively in this cohort were incidental and not the same as the biopsied nodule. The ITN cohort also included 4 patients who planned to undergo a TL, but had a TT after learning the results of intraoperative frozen section.

Decision Making about the Extent of Surgery for PTMC

Next, we examined decision making about the extent of surgery for those patients diagnosed with PTMC in the preoperative period. A *patient reason* for the choice of procedure (TL vs. TT) was documented in 84.2% of cases, and at least one *surgeon reason* was documented for all patients. Analysis of all pertinent records indicated that the only *patient reason* documented about why the patient underwent a TT or a TL was that the patient followed or agreed with the “surgeon’s recommendation.” We did not identify any other *patient reasons* or preferences regarding the surgical approach, such as wanting to avoid a second surgery or avoid taking thyroid hormone replacement. An example of documentation classified as “surgeon recommendation” included the following: “We recommended a total thyroidectomy, and the patient was amenable to this.” In the other 16.8% of cases,

documentation revealed no discussion about the patient with respect to surgical decision making.

Documentation of specific reasons for surgeons recommending a TT to patients diagnosed with PTMC preoperatively demonstrated that patient and/or disease factors (34.6%) were most commonly cited (Figure 1). The specific patient and disease factors are listed individually in Figure 1 and depicted in grey. The next most frequent reason for surgeons recommending a TT was that TT was the “standard treatment” for PTMC (21.7%). An example of the documentation that was classified as “standard treatment” was, “We talked to [the patient] about the treatment of papillary thyroid cancer, which would involve a total thyroidectomy.” Other reasons for recommending a TT included “ease of follow up” (8.7%) and “referring physician preference” (4.3%). In 30.4% of cases, the surgeon did not document an explicit reason for their recommendation. For example, documentation only stated, “I have recommended that [the patient] undergo total thyroidectomy,” without providing any additional detail as to why the recommendation was made. Of note, the cohort of patients who underwent a TT included one patient with a family history of thyroid cancer and two with a history of radiation exposure, but these characteristics were not documented as reasons for recommending TT.

TL was recommended by the surgeon for 1 patient diagnosed with PTMC preoperatively, because a history of a gastric bypass increased the risk for permanent hypocalcemia. In addition, the patient’s tumor was considered to be “small.” Overall, discussion of TL as a potential treatment option was only documented in 1 (5.6%) of the 18 preoperatively diagnosed patients who underwent a TT. In addition, we did not observe documentation of other factors that are known to impact the decision about the extent of surgery, such as compressive symptoms (pain, pressure, voice change, or shortness of breath) or contralateral nodules. For the patients incidentally diagnosed with PTMC following thyroidectomy, documented indications for surgery did include these other factors, including symptoms of compression as well as enlargement of the thyroid nodule, hyperthyroidism and indeterminate cytology.

Decision Making for Completion Thyroidectomy (CT)

A subset analysis of 32 patients discovered to have PTMC on final pathology after a TL demonstrated that 31.3% (n=10) underwent completion thyroidectomy (TL+CT) (Table 2). We detected no significant differences in age or PTC subtype between the patients who did or did not undergo a CT. The TL only patients tended to have smaller tumors, though this finding was not statistically significant (0.4 ± 0.3 cm vs. 0.6 ± 0.3 cm, $p=0.07$) (Table 2). At the initial operation, no patients had nodal metastases. Examination of the pathology demonstrated that patients who only underwent a TL were significantly less likely to have multifocal tumors (9.1% vs. 50%, $p=0.02$). However, we observed no differences between the TL only and TL+CT patients with respect to the proportion who had extrathyroidal extension ($p=0.31$). No patients had positive margins, lymphovascular invasion or angioinvasion. Of the 9 patients who underwent a CT, 6 (66.7%) had at least one additional PTMC in their CT specimen.

Discourse analysis of decision making in the 31 adult patients who had either a TL+CT or TL only showed that documentation of a *patient reason* for the treatment decision was more common in patients who had a TL+CT (90% vs. 13.6% for TL only, $p=0.0001$). For the TL+CT patients who had a *patient reason* documented, the reasons were to avoid future FNA or ultrasound (66.7%) or because of the “surgeon’s recommendation” (33.3%). On the other hand, in the TL only patients, the reasons for not having a CT were that the patient did not want additional surgery (66.7%) or the “surgeon recommended” against having a CT (33.3%).

When analyzing *surgeon reasons* for recommending or not recommending a CT, documentation of a reason was found in 70% ($n=7$) of TL+CT patients and 81.8% ($n=18$) of TL only patients. For the patients who underwent a TL+CT, the reasons surgeons recommended a CT included multifocal disease (25%), hypothyroidism (25%), ease of follow-up (12.5%) and evidence of metastatic disease (12.5%). In the remaining 25% of TL+CT cases, the surgeon recommended CT, but documented no explicit reason for their recommendation. In the patients who underwent TL only, the most frequent *surgeon reason* for recommending against a CT was that no further surgery was the “standard treatment” for incidentally discovered PTMC (56.6%). Other *surgeon reasons* included small “tumor size” (26.1%), no suspicion of malignancy in the contralateral lobe (13%), and that the tumor was unifocal (4.3%).

Outcomes

When we examined the outcomes of those patients with preoperatively diagnosed PTMC, 21.1% ($n=4$) experienced a complication, one of which was permanent. These complications included transient hypocalcemia (15.8%), a chyle leak (5.3%), and permanent hypocalcemia (5.3%). This rate of permanent hypocalcemia was almost twice that of the rest of the cohort (2.8%, $n=3$), though the difference was not statistically significant ($p=0.49$). None of the preoperatively diagnosed patients experienced transient or permanent hoarseness, hematoma, readmission, or local or nodal recurrence. In addition, no deaths from thyroid cancer occurred in the cohort.

Discussion

In this study we found that almost 95% of patients with preoperatively diagnosed PTMC underwent a total thyroidectomy (TT). Compared to patients whose diagnosis of PTMC was discovered incidentally on postoperative pathology, the patients diagnosed preoperatively were significantly more likely to undergo a TT. Analysis of documentation indicated that the surgeon’s recommendation was the main factor driving the treatment decision. Their reason for recommending a TT was most commonly because of disease or patient related characteristics or because TT was the “standard treatment.” During the study period, thyroid lobectomy (TL) was an acceptable alternative endorsed by the ATA guidelines. Nonetheless, documentation rarely stated that TL was discussed as an option. Whether this finding indicates a true lack of discussion or a deficit in documentation is unclear, but emphasizes the need to improve the quality of the EMR and capture all elements of shared decision-making. Interestingly, in the subset of patients who initially underwent a TL, we found that

documentation of patients' preferences about completion thyroidectomy (CT) was much common, perhaps indicating decreased provider bias and increased shared decision-making. While EMR records certainly do not reflect the complete patient-provider discussion, these data are the first to provide a window into decision-making about the extent of surgery for PTMC in actual clinical practice.

In our study cohort, 95% of patients who potentially had a decision to make regarding the extent of surgery for PTMC underwent TT. Of note, these decisions were made in the context of the 2009 ATA guidelines which did not emphasize TL as the standard of care. The high proportion of patients undergoing TT in our study is comparable to the 96% rate previously reported by our institution on PTMC patients treated between 1994 and 2007 (16). These rates are likely higher than those reported in the literature, 59% to 89%, because our analysis only examines decisions for patients already diagnosed with cancer, whereas large database studies include patients diagnosed both preoperatively and incidentally on postoperative pathology (9, 17–20). When examining all 125 patients with PTMC in our study, 72.8% underwent TT, which is within the range reported by others. In addition, our overall reported rate is nearly identical to that reported by Wang and colleagues (73.4%) who analyzed SEER data from 1988 to 2010, a time period during which the rate of TT increased significantly (6).

The extent of surgery chosen in these patients is important because recent data indicate that there is no survival difference between those who undergo TL and TT (18, 20). Consequently, this lack of a survival benefit from TT is considered by many to represent overtreatment, because the risks of harm from the more extensive surgery outweigh the survival benefits. In addition, studies of active surveillance for PTMC also show similar survival, although 7–32% of patients eventually undergo surgery due to tumor enlargement, the development of metastases, or the patient's preference (21–25). While evidence exists to support TL and active surveillance as viable treatment options, the majority of patients with PTMC in the past underwent TT. Whether or these less aggressive management strategies will be adopted is unclear. Our unpublished data indicate that providers pre-existing treatment biases, fear of poor outcomes, own fear of cancer are potential barriers. Recently published data from D'Agostino et al. also support the notion that the patients' reactions to the word "cancer" elicits a response and subsequent urgent need to undergo surgery (26). Together, these factors play an integral role in the overdiagnosis and overtreatment of thyroid cancer, and others like prostate cancer. As such, strategies will likely be needed to support implementation of less aggressive treatments.

Examination of early stage prostate cancer, another preference-sensitive treatment decision, demonstrates similar observations on the importance of the physician's recommendation and the presentation of treatment options. Prostate cancer is analogous to PTMC because of the increased incidence of early stage disease and the multiple treatment alternatives available (27, 28). In prostate cancer, data demonstrate that the provider's recommendation is the most important factor in patients' decisions to undergo less aggressive, non-operative management (29). Studies further indicate that prostate cancer patients are not always presented with all of the treatment options; and the type of treatment recommended depends heavily on the specialty and practice setting of the treating physician (30, 31). One study

shows that patients' treatment choices can actually be predicted by the provider's recommendation (32). Given these findings, it is not surprising that the recommendations of PTMC providers' also drive decision-making. Considering providers' level of expertise and intimate knowledge of the disease, their recommendation should be a main driver of treatment decision-making, as long as the process adequately informs patients and considers their values and preferences, particularly when no clear best treatment exists.

The finding that provider recommendations are important in a similarly over-diagnosed disease supports the need for further study of provider recommendations and patient-provider communication in those with PTMC. In addition, interventions shown to help prostate cancer patients and providers choose the most appropriate treatment option can serve as a model for developing similar tools for patients with PTMC. For example, in low-risk prostate cancer patients, decision aids combined with an education program that addresses patient and provider uncertainty promotes preference based decision-making, improves patient knowledge, enhances patient-provider communication, and reduces decision regret (33). Therefore, as providers, we must acknowledge and address our own biases and ensure that (1) patients are aware of all of their treatment options, and (2) their preferences are considered in the decision-making process (34).

In the present study, 21% of patients with preoperatively diagnosed PTMC had a complication and 5.3% had a permanent complication. We found no significant difference in the rate of permanent complications when we compared those with pre- versus postoperatively diagnosed PTMC; however, the study was significantly underpowered to detect a difference in outcomes. Larger studies of patients undergoing thyroid surgery demonstrate appreciably higher risks of permanent complications for TT compared to TL (10, 35). While these rates tend to be low, the risk of complications is higher in low-volume surgeons who perform the majority of thyroid surgery in the United States. In addition, long-term complications have a significant impact on a patient's quality of life in many ways, including need to take lifelong thyroid hormone replacement after TT (10, 11, 36, 37). Therefore, when making treatment decisions, patients need to be able to understand and weigh the risks against the benefits of the various treatment options, as TL or active surveillance may be more appropriate for certain patients.

In the effort to align patients' preferences and values with their treatment choices, understanding what outcomes are important to patients with PTMC will also be key. In this study, surgeons often documented discussion of the options for those who had PTMC diagnosed after a TL and were choosing whether or not to undergo a CT. However, for those who had PTMC diagnosed preoperatively, discussion of TL as an option was documented in only 1 of the 18 patients, and actual patient preferences were not cited. The reason for this disparity is unclear, but deserves further attention. Because recent changes in the ATA guidelines include a third management option (active surveillance) for patients with PTMC and stress TL as standard surgical treatment, we will need to focus attention on this complex decision-making process to assure continued quality for these patients. Furthermore, documentation of patients' preferences and the shared decision-making process by surgeons may also become an important part of the quality movement, particularly in preference-sensitive cases like PTMC, but also for non-malignant diseases, such as appendicitis.

While this study has several strengths, we acknowledge that there are also several limitations. One limitation is that this investigation was conducted at a single institution which potentially limits the generalizability as our treatment pattern for PTMC may vary from that of other institutions. However, the 9 surgeons included here did their terminal or fellowship training at 5 different institutions across the United States. In addition, the single institution design allowed us to examine data that are not available in large national databases, such as documented indications for surgery and aspects of decision-making. Nevertheless, the data we present were extracted from documentation and were not captured during actual conversations. Templated notes in the EMR also may limit the language used by surgeons to document decision-making. However, only 2 surgeons regularly used templated notes predominantly during the last 2 years this study. Because both of these authors (SCP and DFS) do decision-making research, their documentation of the decision-making process was extensive (15). Nonetheless, we may have missed other important factors in decision-making about the extent of surgery in patients with PTMC. Our data so highlight the need to document patient preferences, particularly when discussing complex, preference sensitive decisions. Because a paucity of data exist on how treatment decisions for PTMC are made, this study provides important insights and data to support more extensive investigation. Ideally, future studies will use qualitative methods to examine the decision-making process in order to gain a more detailed understanding of what drives patients' and surgeons' decisions.

Conclusions

In conclusion, almost all patients in this study who were diagnosed with PTMC prior to surgery underwent a total thyroidectomy. Documentation suggests that the main factor driving this treatment decision was the surgeon's recommendation. In addition, documentation of the discussion of other treatment alternatives or the patient's preference was rare. These findings indicate that surgeons do not capture the shared decision making process in the medical record, which is potential area for quality improvement. Recently published guidelines from the American Thyroid Association recommend less aggressive approaches like thyroid lobectomy and active surveillance, which creates a significant paradigm shift in the treatment of these patients. Further understanding the reasons behind patient, surgeon, and patient-surgeon decision-making will be key in the development of interventions that assist patients in choosing the most appropriate, preference-based treatment for PTMC.

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Figure 1. Documented Surgeon Reasons for Decision-Making about the Extent of Thyroidectomy for PTMC. The graph depicts *surgeon reasons* for recommending total thyroidectomy (TT) to patients diagnosed with PTMC preoperatively in order of frequency. Patient and disease factors are shown in grey and other factors are shown in black.

Table 1

Pre- and Postoperative Characteristics of Patients with PTMC

Variable	All Patients (n=125)	Pre-Op Diagnosis (n=19)	Post-Op Diagnosis (n=106)	P-Value
Age, mean (+/-SD), years	50.1 (± 14.6)	46.6 (± 17.0)	50.1 (± 14.2)	0.25
Age Range	5–78	21–77	5–78	-
Gender, n (%)				
Female	107 (85.6%)	16 (84.2%)	91 (85.8%)	0.74
Ethnicity, n(%)				
Caucasian	113 (90.4%)	16 (84.2%)	97 (91.5%)	-
African American	2 (1.6%)	1 (5.3%)	1 (0.9%)	-
Other*	8 (6.4%)	1 (5.3%)	7 (6.6%)	-
Unknown	2 (1.6%)	1 (5.3%)	1 (0.9%)	-
Family History of Thyroid Cancer, n (%)	17 (13.6%)	1 (5.3%)	16 (15.1%)	0.47
History of Radiation Exposure, n (%)	5 (4.0%)	2 (10.5%)	3 (2.8%)	0.17
FNA Result, n (%)[#]				
Non-Diagnostic	6 (4.8%)	-	6 (5.7%)	-
Benign	37 (29.6%)	-	37 (34.9%)	-
Atypical or FLUS	21 (16.8%)	-	21 (19.8%)	-
FN or Suspicious for FN	18 (14.4%)	-	18 (17.0%)	-
Suspicious for PTC	11 (8.8%)	-	11 (10.4%)	-
Surgery, n (%)				
Thyroid Lobectomy	34 (27.2%)	1 (5.3%)	33 (31.1%)	0.02
Total Thyroidectomy	91 (72.8%)	18 (94.7%)	73 (68.9%)	
Largest Tumor Size, mean (+/-SD), cm	0.51 (± 0.3)	0.80 (± 0.2)	0.47 (± 0.3)	0.0001
PTC Type, n (%)				
Classic PTC [§]	73 (58.4%)	18 (94.7%)	55 (51.9%)	0.0003
Follicular variant PTC	45 (36.0%)	1 (5.3%)	44 (41.5%)	
Combination PTC/Follicular variant PTC	6 (4.8%)	0 (0%)	6 (5.7%)	
Tall Cell variant PTC	1 (0.8%)	0 (0%)	1 (0.9%)	

PTMC, papillary thyroid microcarcinoma, SD = standard deviation, FNA = fine needle aspiration, FLUS = follicular lesion of undetermined significance, FN = follicular neoplasm, PTC = papillary thyroid cancer.

* Other ethnicities include Asian, American Indian or Alaska Native and Hispanic/Latino.

[#] 13 post-operatively diagnosed patients did not have an FNA performed.

[§] P-value for Classic PTC compared to other 3 PTC types combined.

Table 2

Extent of Surgery and Tumor Characteristics for Thyroid Lobectomy (TL) Patients

Variable	TL only (n=22)	TL + CT (n=10)	P-Value
Age, mean ($\pm$ SD), years	53.3 ($\pm$ 10.7)	48.6 ($\pm$ 11.0)	0.26
Largest Tumor Size, mean ($\pm$ SD), cm	0.4 ($\pm$ 0.3)	0.6 ($\pm$ 0.3)	0.07
Pathology *			
PTC	13 (59.1%)	5 (50%)	0.71
Follicular variant PTC	9 (40.9%)	5 (50%)	
Multifocal	2 (9.1%)	5 (50%)	0.02
Extrathyroidal Extension	0 (0%)	1 (10%)	0.31
Additional PTMC in CT specimen	-	6 (67%) [#]	-

CT = completion thyroidectomy, SD = standard deviation, PTC = papillary thyroid cancer, PTMC = papillary thyroid microcarcinoma.

* No patients had positive margin, lymphovascular invasion or angioinvasion.

[#] 6 of 9 (1 patient had CT planned, but not performed, at the time of this study).