Core needle biopsy provides more accurate pre-surgical assessment of thyroid lesions than fine needle aspirates

Trinithas Boyi MA[1,2], Alison C. Ma MS[1,2], S. Lynn Sigurdson PhD[1], William J. Magner PhD[1], Kimberly E. Wooten MD[1], Ryan P. McSpadden MD[1], Wesley L. Hicks, Jr DDS MD[1,2], Vishal Gupta MD[1]

[1]Head & Neck Surgery, Roswell Park Comprehensive Cancer Center, Buffalo, NY;
[2]Jacobs School of Medicine & Biomedical Sciences, University at Buffalo, Buffalo

Abstract

Pre-surgical diagnosis of thyroid carcinoma typically relies on biopsy or cytology. Fine needle aspiration (FNA) allows for cytological assessment. Depending on the sampling, FNA can accurately identify thyroid malignancy; however, in many cases, FNA findings are inconclusive. Several institutions, including Roswell Park Comprehensive Cancer Center (RPCCC), presently evaluate the tissue architecture and cellular component of thyroid nodules by performing core needle biopsy and smears. This method has been shown to generally have a lower non-diagnosis result rate, when compared to FNA. We propose that core needle biopsy pathology is more effective than fine needle aspiration cytology in identifying and properly classifying thyroid tumors. In a retrospective review of papillary thyroid cancer (PTC) cases at our institution, we found that pathology assessment of surgical samples agreed with pre-surgical characterization based on core needle biopsy 1.78-times more often than with pre-surgical fine needle aspirate cytology. Review of Tall Cell Variant (TCV) cases, which is a particularly aggressive variant of PTC, demonstrated that core needle biopsies were 1.6-times more likely to correctly identify TCV cases pre-surgically. In this scenario, accurate pre-surgical diagnosis facilitates appropriate surgical planning – our practice is total thyroidectomy for TCV rather than lobectomy. Patients benefited from correct pre-surgical diagnosis in receiving a single surgery and prompt management of their disease.

Introduction

Thyroid cancer is the fifth most common cancer amongst women in the United States and the most common endocrine malignancy. Up to 70% of thyroid cancer consists of Papillary thyroid cancer (PTC). In recent decades, there has been increasing incidence of PTC worldwide, bringing much attention to the topic. Although conventional PTC is considered an indolent tumor with 93% 10-year survival, variants at the end of the spectrum have been associated with aggressive behavior. The most common of the aggressive variants is the tall cell variant (TCV), named after its histopathological features. The 2017 WHO Classification of Tumors of Endocrine Organs defines TCV as tumors with greater than 30% predominance of cells that are 3x as tall as wide. TCV has been associated with greater extrathyroidal extension, older age, and overall worse clinical prognosis.

Until resection can be performed for a surgical diagnosis, pre-surgical evaluation methods are necessary to determine appropriate management of disease. Historically, fine needle aspiration cytology (FNAC) has been used as the main method for thyroid nodule evaluation, reporting cytological findings using the Bethesda System for Reporting Thyroid Cytopathology (TBSRTC). Despite it being the gold standard, FNAC frequently yields results of unsatisfactory and atypia/follicular lesion of undetermined significance. Recently, core needle biopsy (CNB) has become popular as an alternative or additional method for diagnosing PTC. Previously the diagnostic accuracy of CNB has been found to be higher than that of FNA for suspicious thyroid nodules and shown to have low rates of inconclusive results.

In this study, we explored the diagnostic accuracy of CNB compared to FNA in cases of tall cell variant papillary thyroid carcinoma to get a better understanding of the most appropriate pre-surgical diagnostic tool to allow for better surgical planning and disease management.

Methods

The Roswell Comprehensive Cancer Center electronic health record was queried for 'malignant neoplasm of thyroid' via SQL and manual extraction (IRB approved retrospective study). Pre-operative pathology and cytology reports were recorded in addition to post-surgery diagnosis. The data was assembled into an SPSS database for demographic, frequency, and survival analyses.

Results

- A total of 93 thyroid cancer cases were identified from 2013-2016.
  - Of these cases, 83 (87.4%) had PTC noted as the primary pathology.
- While Roswell Park favors CNB for pre-operative sampling, most outside facilities rely on FNA (Figure 1). Some patients had both FNA and CNB procedures.

1 In-House vs. Outside Reports

	RPCCC	Outside Facility	Both	Total # Performed
Pathology Facility	34	2	1	39
Cytology Facility	16	43	16	75

- CNB and FNA has similar success in correctly diagnosing pre-operative samples (Figure 2).
  *Pre-op Dx of PTC was considered correct, even if PTC variant was not identified.

2 % of Correct Pre-surgical diagnoses

	Performed	Pre-op same as Post-op Dx (%)*
CNB only	39	21 (54.8%)
FNA only	75	40 (53.3%)

- In total, 13 tall cell variant cases and 7 PTC with tall cell feature cases were identified.
- Overall, CNB and FNA showed similar success in identifying PTC, but FNA showed no indication of TCV. One CNB sample correctly diagnosed the tall cell variant in the pre-operative sample (Figure 3).

3 Tall Cell Variant (TCV) Cases

	Performed	Pre-op Dx of TCV	Pre-op Dx of PTC
CNB only	5	1	4
FNA only	10	0	9

- Although very few CNBs were classified as tall cell feature cases, of the 3 performed, 1 was able to correctly identify tall cell features (Figure 4).

4 PTC with Tall Cell Feature (TCF) Cases

	Performed	Pre-op Dx of TCF	Pre-op Dx of PTC
CNB only	3	1	1
FNA only	6	0	3

Discussion

While PTC is normally considered an indolent malignancy, aggressive variants such as TCV must be diagnosed early to prevent poor outcomes. Previous literature has reported TCV to constitute between 3.2 and 19% of PTC cases. From 2013-2016, RPCCC reported 14% of its PTC cases to be tall cell with an additional 9.7% containing tall cell features. Of note, Roswell's incidence of TCV is at the high end of the reported range. More research must be done to understand this finding; possible factors include environment and pathological diagnostic criteria.

Of the 13 TCV cases identified most of the patients had FNA performed (10/13), while less than half had CNBs done (5/13). Although current protocol at RPCCC is to use CNB, many patients are referred from outside facilities that may still preferentially use FNA. Using FNA alone, PTC was successfully diagnosed before surgery most of the time in TCV patients (9/10), but FNA was not found to ever identify tall cells. When CNB was used, 4/5 cases were correctly identified as PTC and in one case, TCV was diagnosed successfully pre-operatively. For PTC with tall cell features, FNA and CNB were less successful at identifying PTC, correctly diagnosing 3/6 and 1/3 cases, respectively. Similar to TCV, only one case was correctly identified as TCF.

Although FNA and CNB reported similar successful pre-op diagnoses, it is worth noting that the limited number of cases in which CNB was used it may bias the result. Additionally, since FNA is typically used at outside facilities that refer to RPCCC, it's possible that these cases were already more aggressive, resulting in a higher successful pre-operative diagnostic rate.

Conclusion

Effective means of diagnosing aggressive variants of PTC are necessary to ensure the best outcomes. Our study revealed FNA and CNB to correctly diagnose PTC at similar rates. CNB correctly identified one case of TCV and TCF each, indicating its potential usefulness in diagnosing tall cells and giving a more accurate picture of the PTC variant. Further studies are necessary with a larger sample size to determine whether one diagnostic tool is more appropriate than the other in identifying aggressive variants of PTC.

References

Na HY, Woo JW, Moon JH, Choi JY, Jeong WJ, Kim YK, Choe JY, Park SY. Preoperative Diagnostic Categories of Noninvasive Follicular Thyroid Neoplasm with Papillary-Like Nuclear Features in Thyroid Core Needle Biopsy and Its Impact on Risk of Malignancy. Endocr Pathol. 2019 Dec;30(4):329-339. doi: 10.1007/s12022-019-09590-5. PMID: 31605276.

Seok JY, An J, Cho HY, Kim Y, Ha SY. Nuclear features of papillary thyroid carcinoma: Comparison of Core needle biopsy and thyroidectomy specimens. Ann Diagn Pathol. 2018 Feb;32:35-40. doi:10.1016/j.anndiagpath.2017.09.002. Epub 2017 Sep 18. PMID: 29414395.

Acknowledgements

This project is supported by funding from the National Cancer Institute of the National Institutes of Health under Award number: 2R25CA181003-06 (TB and AM)
We would like to thank Dr. Mihai Merzianu and Preethi Mozhiyil Chathoth for their assistance with identifying patients for this study.