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Research Article

Accuracy of Fine Needle Aspiration (FNA) of the Thyroid in Identifying Papillary Carcinoma in Liquid-Based Cytology

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Abstract

Background: The accuracy of FNA of the thyroid in predicting papillary carcinoma in large studies ranges from 94 to 98%. The unsatisfactory / non-diagnostic rate is usually around 5% this is based on studies performed mostly on conventional smears. We compare these studies with FNA of the thyroid using liquid-based (ThinprepTM) cytology.

Methods: We reviewed cases of papillary carcinoma of the thyroid diagnosed by histology in our institution between January 2010 and December 2011. We only included cases that had previous FNA. We have used exclusively liquid-based cytology (ThinprepTM) since 1996. Cases of micro-carcinoma (<1 cm) were excluded from the study. Cases diagnosed by FNA as benign or follicular lesion were considered negative and those given the diagnosis of follicular neoplasm, suspicious, or papillary carcinoma were considered positive.

Results: There were 149 cases of papillary carcinoma of the thyroid diagnosed by surgical resection and that had a previous FNA. FNAs were positive in 132 of the cases (88%). Three cases were unsatisfactory (2%) and 15 cases were negative (10%). Of the 15 negative cases 9 (60%) were called follicular lesion. Review of the negative cases showed difficulty in identifying nuclear abnormalities and papillary architecture. Colloid and its patterns were difficult to identify.

Conclusion: The use of liquid-based cytology shows a higher yield of diagnostic material for the identification of papillary carcinoma of the thyroid with a lower incidence of non-diagnostic material. The false negative rate is however higher than reported in the literature that may be related to difficulty identifying nuclear abnormalities, background colloid and papillary architecture.

Introduction

Clinical management of thyroid lesions is, for the most part, dependant on the result of Fine Needle Aspiration (FNA) of the thyroid. FNA findings will usually determine whether the patient will be observed, medically or surgically treated. The increase in accuracy in FNA interpretation of the thyroid leads to improvement in the management of thyroid lesions and will minimize unnecessary surgery. More than 350,000 FNAs of the thyroid are performed annually in the United States [1,2]. It is therefore of paramount importance in the grand scheme of improvement of health care efficiency.

The accuracy of FNA of the thyroid in predicting papillary carcinoma in large studies ranges from 94 to 98% [3-9]. The unsatisfactory / non-diagnostic rate is usually around 5% this is based on studies performed mostly on conventional smears. Cytopathologic features used to identify papillary thyroid carcinoma include thick colloid, nuclear enlargement, pale chromatin, nuclear grooves, intranuclear inclusions, and nuclear crowding. Limitations for cytopathologic diagnosis of papillary thyroid cancer include pathologist ability to identify typical features, particularly when the

presence of underdeveloped nuclear enlargement, pale chromatin, and intranuclear inclusions are used as identifying features [10].

Following the FDA approval of ThinPrep (TP) for use in nongynecological and FNA material, increased utilization of the technology has been observed. We have been using Liquid-Based Cytology (LBC) in our institution exclusively for the past 15 years. This was implemented following a study in which it was determined TP had a lower proportion of inadequate specimen, decreased false negatives, as well as a higher proportion of true negatives [7]. Advantages of TP include ease for clinician submission, consistency in specimen quality, uniform collection, perseveration of nuclear detail, decreased screening time, decrease in specimen fixation and smear artifact, shorter time for interpretation, and the ability to perform ancillary testing on specimens [9,10]. However, in Duncan et al review of the literature, limitations of TP that discourage from its sole use as a diagnostic medium includes loss of diagnostic stromal constituents, disruption in epithelial stromal relationships, and shrinkage artifacts. In addition, we noticed that certain diagnostic artifacts are not seen in LBC. These include unclear nuclear changes, loss of colloid, and loss of papillary clusters. In this study, we attempted to identify the diagnostic accuracy of identifying papillary carcinoma of the thyroid in our lab using LBC. We compared our findings with large studies in the literature using conventional smearing.

Materials and Methods

Calgary laboratory services serve a population of approximately 1.2 million. There are approximately 12 cytopathologists reviewing cases of FNA of the thyroid. We reviewed cases of papillary carcinoma of the thyroid diagnosed by histology in our institution between January 2010 and December 2011. We only included cases that had previous FNA. We have used exclusively liquid-based cytology (ThinprepTM) since 1996. Cases of microcarcinoma with tumors less than 1 cm in diameter were excluded from the study. We did not use the Bethesda system in our diagnoses as it the system has not been fully adopted in our laboratory. In our review two categories of diagnosis were used. Cases diagnosed by FNA as benign or follicular lesion were considered negative and those given the diagnosis of follicular neoplasm, suspicious, or papillary carcinoma were considered positive. The cases were mainly reviewed by two pathologists (WAM and DGF). Cases that were called positive were reviewed to identify the possible reasons for false negative diagnosis. The total number of cases included in the study was 149.

Results

There were 149 cases of papillary carcinoma of the thyroid diagnosed by surgical resection and that had a previous FNA. Cytologic criteria for the diagnosis of papillary carcinoma included overlapping cellular clusters, stringy colloid and nuclear clearing of the cells. FNAs were positive in 132 of the cases (88%). Three cases were unsatisfactory (2%) and 15 cases were negative (10%). Of the 15 negative cases 9 (60%) were called follicular lesion. Review of the negative cases showed several problems associated with LBC. Colloid, for the most part, was missing in the preparations. Papillary configurations were very difficult to identify (Figure 1).

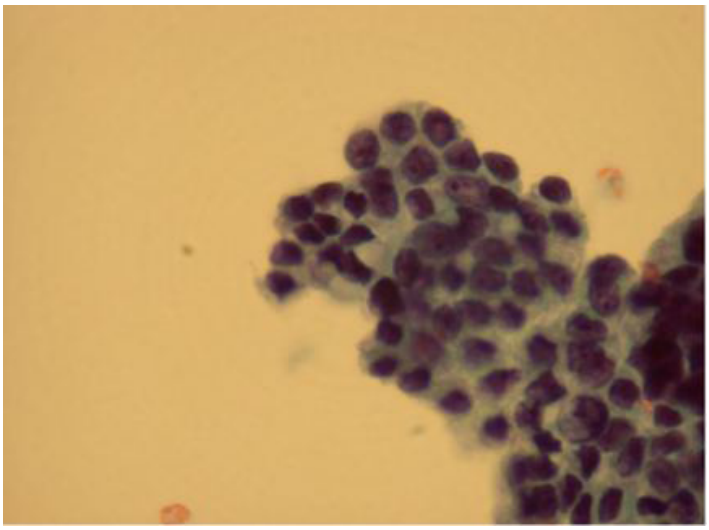

Figure 1: A cluster of papillary carcinoma not exhibiting papillary configuration (Papanicolau stain X40)

The cells were more cohesive and tightly arranged than in conventional smears (Figure 2).

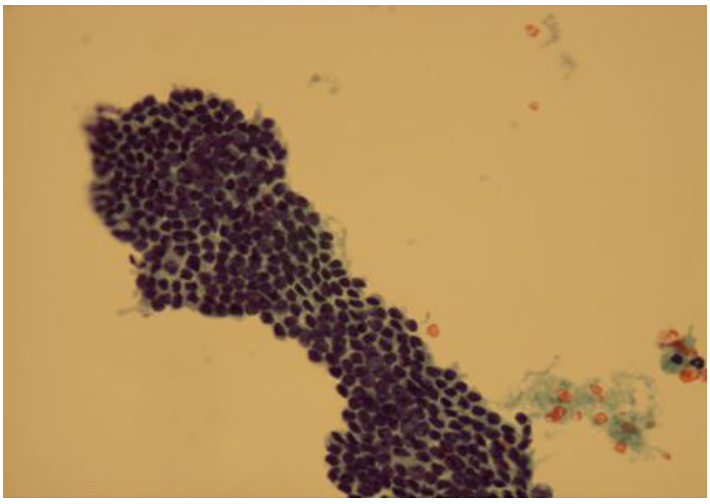

Figure 2: Cluster of papillary carcinoma exhibiting cohesive cells (Papanicolau stain X40).

Nuclear features manifested in pale chromatin, nuclear grooves and intra-nuclear inclusions were not readily seen (Figure 3A).

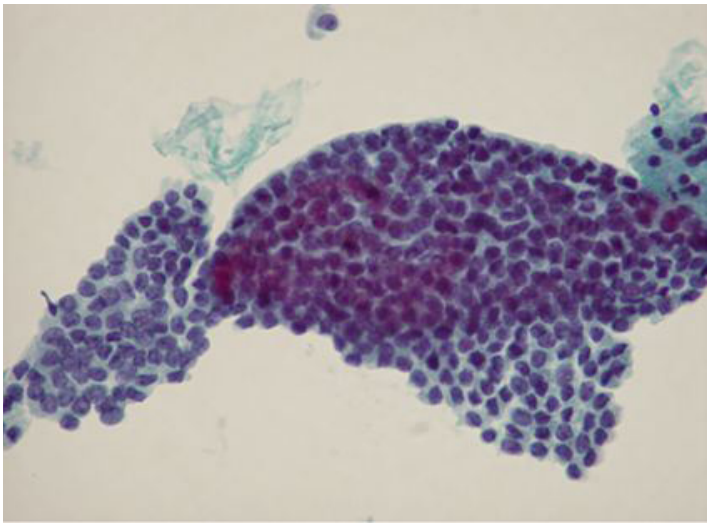

Figure 3 A: Papillary carcinoma whowing no evidence of nuclear changes (Papanicolau stain X40).

The nuclear features were clearly seen in the histological sections of the same case (Figure 3B).

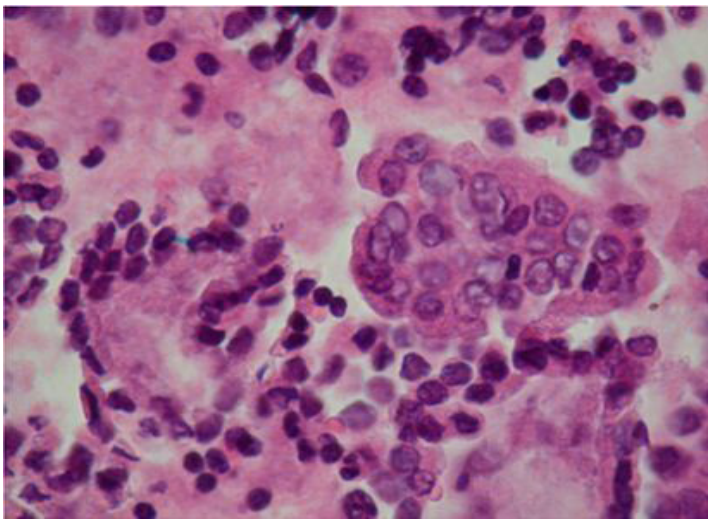

Figure 3B: Same tumor showing the typical nuclear features of papillary carcinoma (H & E stain X40).

Discussion

Management of a solitary thyroid nodule is highly dependant on the diagnosis rendered by FNA. The number of unnecessary surgery with its associated morbidity will depend on the diagnostic accuracy of FNA. False positive diagnosis will lead to more unnecessary surgery with its associated cost. False negative rate on the other hand will lead to missing of malignant tumors of the thyroid and the potential long term increase in mortality [1,2,11,12]. The introduction of the Bethesda system of nomenclature has led to a more standardized scheme of thyroid lesion classification. There are still however categories that require refinement [13,14]. In spite of these improvements there remain lesions that defy the diagnostic capability of many pathologists. This includes Follicular Lesions of Undetermined Significance (FLUS) which is responsible for most under or over-diagnosed lesions [13].

The use of liquid based cytology has many advantages, including but not limited to the ability to perform ancillary testing, preservation of nuclear details, decreased smear artifact, decreased screening time, clinician submission convenience, and shorter time for interpretation [15]. However, the role of LBC in the assessment of solitary thyroid nodules has been poorly defined with conflicting results in diagnostic accuracy. Limited studies have specifically assessed LBC's diagnostic accuracy in the identification of papillary thyroid carcinoma. In our study, we report a diagnostic accuracy of 88%, and non-correlation of 2%, with a false negative of 10%. We found that the use of liquid-based cytology shows a higher yield of diagnostic material for the identification of papillary carcinoma of the thyroid with a lower incidence of non-diagnostic material. However, the false negative rate was found to be higher than that reported in the literature. This was thought to be related to difficulty in identifying nuclear abnormalities and papillary architecture as well as the loss of the typical appearance of colloid. Similarly, Afify et al reported on the loss of Colloid in TP, as well as change in consistency [16].

In their study, Duncan et al found an accuracy of 64% and a non-correlation rate of 36% in the diagnoses of papillary thyroid cancer. Non-correlation was thought to be related to insufficient cellularity. They noted retained features typically seen with conventional smears on LBC including papillary configurations, overlapping cell clusters, nuclear grooves, and powdery chromatin [17]. Cochand-Priollet et al similarly reported that characteristic features of PTC found on TP was consistent with presence of nuclear grooves and powdery chromatin, and less likely to be associated with cytoplasmic inclusions [17]. Luu et al also reported on the diagnostic accuracy of papillary carcinoma with TP, and determined to be 34% [18]. A recent large study by the college of American pathologists of close to 50,000 of FNA of the thyroid has shown an inferior performance of liquid based cytology when compared to conventional cytology [19]. The study undertaken in several North American laboratories showed a predominance of conventional smears (94%) versus liquid-based cytology (6%). This indicates that liquid-based cytology has not gained popularity in North America. In summary, the use of liquid-based cytology in the diagnosis of thyroid cancer has shown some improvement in the reduction of the non-diagnostic rate when compared to conventional cytology. It however may show a higher level of false negative rates when compared to conventional cytology. The lack of established Cytologic criteria in liquid based cytology is due to the fact that liquid based cytology is a new method. This may

however improve in time as pathologists will become more used to the technology and create relevant cytologic criteria of malignancy using the new technology.

References

1. Faquin WC, Bongiovanni M, Sadow PM (2011) Update in thyroid fine needle aspiration. Endocr Pathol 22: 178-183.
2. Cibas ES (2010) Fine-needle aspiration in the work-up of thyroid nodules. Otolaryngol Clin north Am 43: 257-271.
3. Ozluk Y, Pehlivan E, Gulluoglu MG, Povanli A, Salmaslioglu A, et al. (2011) The use of the Bethesda terminology in thyroid fine-needle aspiration results in a lower rate of surgery for non-malignant nodules: a report from a reference center in Turkey. Int J Surg Pathol 19: 761-771.
4. Yan J, Schnadig V, Logrono R, Wasserman PG (2007) Fine-needle aspiration of thyroid nodules: a study of 4703 patients with histologic and clinical correlation. Cancer 111: 306-315.
5. Lew JL, Snyder RA, Sanchez YM, Solorzano CC (2011) fine needle aspiration of the thyroid: correlation with final histology in surgical series of 797 patients. J Am Col Surg 213: 188-194.
6. Wang CC, Friedman L, Kennedy GC, Wang H, Kebebew E, et al. (2011) A large multicenter correlation study of thyroid nodule cytopathology and histopathology. Thyroid 21: 243-251.
7. Gharib H (1994) Fine-needle aspiration biopsy of thyroid nodules: Advantages, limitations and effect. Mayo Clin Proc 69: 44-49.
8. Coorough N, Hudak K, Bueher D, Selvaggi S, Sippel R, et al. (2011) Fine needle aspiration of the thyroid: a contemporary experience of 3981 cases. J Surg Res 170: 48-51.
9. Nga ME, Kumarainghe MP, Tie B, Sterrett GF, Wood B, et al. (2010) Experience with standardized thyroid fine-needle aspiration reporting categories: follow-up data from 529 cases with “undetermined” or “atypical” reports. Cancer Cytopathol 118: 423-433.
10. Scurry JP, Duggan MA (2000) Thin layer compared to direct smear in thyroid fine needle aspiration. Cytopathol 11: 104-115.
11. Olson MT, Boonyaarunnate T, Aragon Han P, Umbrichtr CB, Ali SZ, et al. (2013) A tertiary center’s experience with second review of 3885 thyroid cytopathology specimens. J Clin Endocrinol Metab 98: 1450-1457.
12. Duncan LD, Forrest L, Law WM, Hubbard E, Stewart LE (2011) Evaluation of thyroid fine needle aspiration: Can Thin-prep be used exclusively to appropriately triage patients having a thyroid nodule. Diagn Ctyopathol 39: 341-348.
13. Texeira GV, Chikota H, Teixeira T, Manfro G, Pai SI, et al. (2012) Incidence of malignancy in thyroid nodules determined to be follicular lesions of undetermined significance on fine needle aspiration. World J Surg 36: 69-74.
14. Renshaw A, Wang E, Haja J, Wilbur D, Henry M, et al. (2006) Fine-Needle Aspiration of Papillary Thyroid Carcinoma, Distinguishing Between Cases That Performed Well and Those That Performed Poorly in the College of American Pathologists Nongynecologic Cytology Program. Arch Pathol Lab Med 130: 452-455.
15. Boman F, Farré I, Farine MO, Leroy JL, Gauthier A, et al. (1999) Why we prefer the thin layer technique to conventional Pap smears. A double-blind study of 473 specimens. Clin Exp Pathol 47: 81-87.
16. Afify AM, Liu J, Al-Khafaji BM (2001) Cytologic artifacts and pitfalls of thyroid fine needle aspiration using ThinPrep: a comparative retrospective review. Cancer Cytopathology 93: 179-186.
17. Cochand-Priollet B, Prat JJ, Polivka M, Thienpont L, Dahan H, et al. (2003) Thyroid fine needle aspiration: the morphological features on ThinPrep slide preparations. Eighty cases with histological control. Cytopathology 14: 343-349.
18. Luu MH, Fisher AH, Pisharodi L, Owens CL (2011) Improved preoperative definitive diagnosis of papillary thyroid carcinoma in FNAs prepared with both ThinPrep and conventional smears compared with FNAs prepared with ThinPrep alone. Cancer Cytopathology 119: 68-73.
19. Fischer AH, Clayton AC, Bentz JS, Wasserman G, Henry MR, et al. (2013) Performance differences between conventional smears and liquid-based preparations of thyroid fine-needle aspiration samples. Analysis of 47 076 responses in the college of American Pathologists interlaboratory comparison program in non-gynecologic cytology. Arch pathol lab med 137: 26-31.