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Image Cytometry Of Fine Needle Aspiration Of Thyroid Epithelial lesions

Thesis

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SUMMARY

Fine needle aspiration (FNA) cytology has emerged as a valuable, popular and routine investigation that can differentiate between benign and malignant thyroid nodules, with no or minimal complications. While the overall accuracy of FNAB is excellent, an indeterminate or suspicious biopsy can pose a diagnostic and management dilemma. Generally, the diagnosis of the follicular neoplasms is a demanding task in cytology and the distinction between follicular adenoma and follicular carcinoma can only be done on histopathological level to assess invasion. Similar difficulties may be present in cytological differentiation between hyperplastic papillae and papillary carcinomas. Therefore, there is a need to refine the results of conventional cytology.

This study aimed to investigate the value of computerized nuclear morphometry and DNA ploidy in differential diagnosis of different thyroid epithelial lesions, in fine needle aspirated samples.

The study included 34 FNA biopsies of different epithelial follicular lesions, divided according to the final histopathological diagnosis (post thyroidectomy) into: 5 cases of nodular goitre, 7 cases of follicular adenoma (including a case of atypical adenoma), 10 cases of papillary carcinoma, 5 cases of follicular carcinoma, 5 cases of anaplastic carcinoma, and 2 cases of poorly differentiated (insular) carcinoma.

Routine Cytological examination of the cases could identify 23 out of 34 cases prior to neck surgery, with sensitivity 81.8%, specificity 41.6% and overall diagnostic accuracy 67.6%

In our study, computer-assisted image analysis of thyroid follicular lesions was based on two lines of data: thyroid cell nuclear morphometry (demonstrated by the nuclear area) and ploidy analysis (demonstrated by % of cells with DNA content $\neq 4.5C$, DNA index and Proliferation index). All the measurements were done using Leica Qwin 500 image analyzer system.

Despite the wide scatter of values of nuclear area within cases, measurement of nuclear area was statistically significant in differentiating benign from malignant lesions with sensitivity 59.09%, specificity 91.67% and overall diagnostic accuracy 70.59%. The nuclear area was found to be significantly larger in malignant lesions.

DNA ploidy could significantly diagnose malignancy (p value 0.00074), with sensitivity 90.9% and specificity 83.33% and overall diagnostic accuracy 88.29%. Aneuploidy was significantly associated with malignancy, with highest mean value observed in anaplastic carcinoma. A case out of 5 cases of nodular goiter and the case of atypical adenoma showed aneuploid DNA pattern. On the other hand, diploidy was observed in 2 cases of 10 cases of the papillary carcinoma. All cases of follicular carcinoma, poorly differentiated carcinoma and anaplastic carcinoma were strongly aneuploid.

Results of DNA index (DI) support the ploidy findings with almost similar sensitivity and specificity. Proliferation index (PI) was significantly higher in the malignant lesions and diagnosed malignancy with a sensitivity reaches 90.1%, specificity 83.38% and overall diagnostic accuracy 88.29%. However, no statistically significant difference was observed between the diagnostic groups.

The best sensitivity and specificity results could be obtained by using more than one technique and no single technique

on its own could give satisfactory diagnostic results that could refine the results of conventional FNAB.

In our study, image cytometry could significantly solve most of the diagnostic dilemmas of cytology; measuring nuclear area, DNA ploidy and DNA index showed significant differences between these groups. However, values of proliferation index could not differentiate between them.

CONCLUSION & RECOMMENDATION:

Despite limitations, FNA has become the mainstay of thyroid nodule evaluation; being safe, cost effective and of great patient compliance. To overcome such limitations the use of DNA ploidy measures & proliferation indices may markedly improve the diagnostic accuracy. Hence, the use of a combination of more than one technique could significantly refine the results of conventional cytology and raise its sensitivity and specificity values.

It is therefore recommended that image analysis be used as an ancillary test in the initial evaluation of patients with thyroid epithelial follicular lesions diagnosed by conventional cytomorphologic criteria following aspiration biopsy.