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TECHNICAL NOTE

The Role of Computer-aided Detection and Diagnosis System in the Differential Diagnosis of Thyroid Lesions in Ultrasonography

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Abstract To avoid abuse of fine-needle aspiration cytology (FNAC) and to save the time of a learning curve, a computer-aided detection and diagnosis (CAD) system to detect suspicious lesions for FNAC from thyroid ultrasonography has been developed by the Department of Industrial Engineering, cooperative with the Department of Surgery at the National Taiwan University, Taipei, Taiwan. The purposes of this article are to introduce how to utilize the CAD system in thyroid ultrasonography, and to outline the real role of the CAD system. After marking the apparently transverse (extending across) axis and longitudinal axis of the nodule appearing by ultrasonography, four parameters are calculated and displayed by the computer system automatically, which include microcalcifications, hypoechoic lesion, heterogeneity, and indistinct margin. The results are displayed by the pointers in the semilunar figures. The necessity of FNAC is dependent on the size and numbers of positive findings (pointers displayed in the right side). This CAD system is objective and easy to use. It may supply an easy method to determine the necessity for FNAC, but what we must keep in mind is that this method can reduce the necessity of FNAC, not replace FNAC for the diagnosis of thyroid cancer.
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Conflicts of interest: The author has never been involved in any funded projects developing the CAD device. All the figures are supplied by one the inventors of this method. Therefore, readers must be careful to judge the feasibility of the method described in this article.

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Introduction

The number of cases of thyroid cancer have the trend of increasing gradually in many countries, including the United States [1] and Taiwan [2,3], although the increase in mortality is not noted. The dramatic increase in the number of thyroid cancer cases is considered to be related to many factors, but increased screening by ultrasonography may be the most important factor [1]. However, the increased incidence across all tumor sizes suggests that increased diagnostic scrutiny is not the only reason [1].

Although it is cheap to carry out fine-needle aspiration cytology (FNAC) in Taiwan, especially under the coverage of health insurance, the work-load would delay the further work-up and management of patients if every case suspected to have thyroid nodule was to be aspirated and read after staining to judge whether it is malignant or not.

In the study reported by Bonavita et al [4], there are several patterns shown by thyroid ultrasonography which are indicative of benignancy, and further FNAC is not necessary. These include spongiform configuration, cysts with colloid clots, giraffe pattern, and diffuse hyperechogenicity. The specificity is 100%. They estimated 60% of FNAC procedures could be saved. Different patterns on thyroid ultrasonograms between benign and malignant lesions have also been stressed [5].

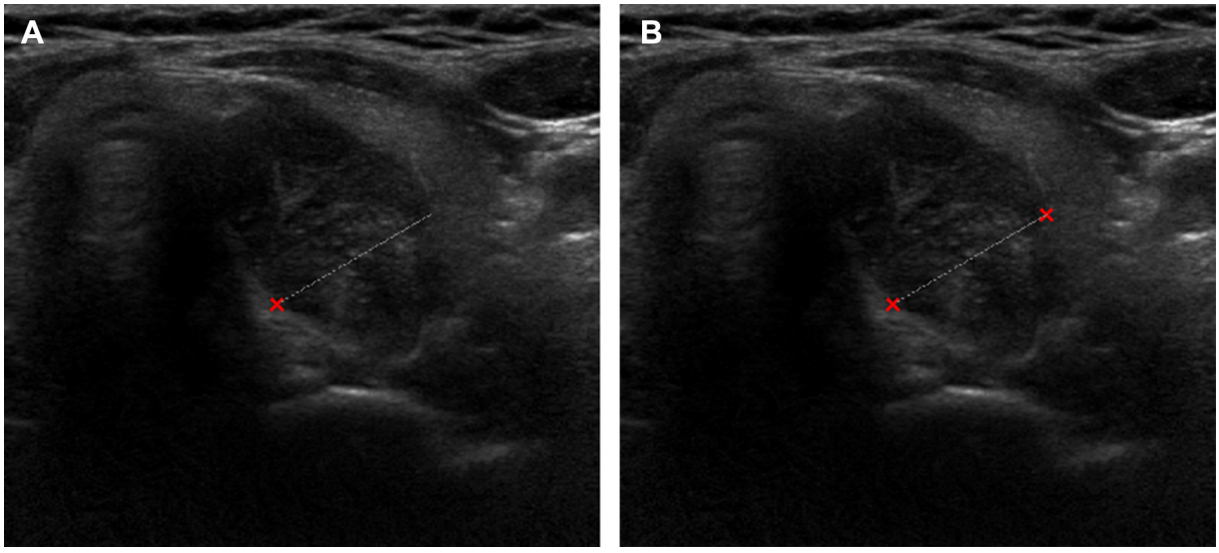

Figure 1 (A) Locate the first point in the left border of the thyroid lesion with the largest diameter. (B) Draw to extend across to the right border with the largest diameter of the lesion. Locate the second point of the middle part in the upper border of the thyroid nodule, then draw to the middle part in the lower border of the thyroid nodule.

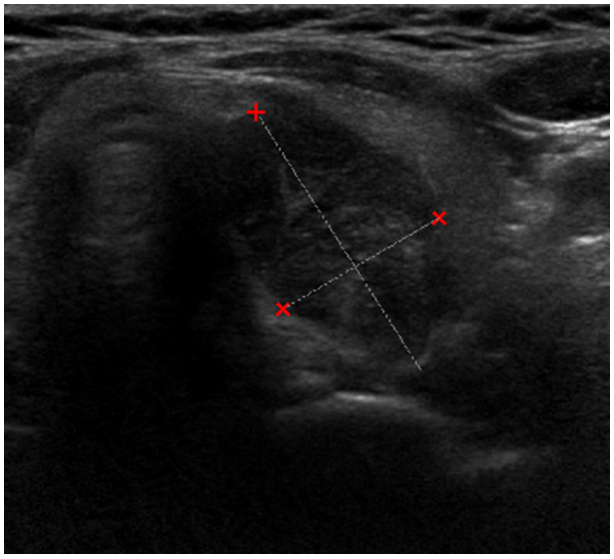

Figure 2 For the longitudinal axis, locate the second point at the middle part in the upper border of the thyroid nodule, then draw to the middle part in the lower border of the thyroid nodule.

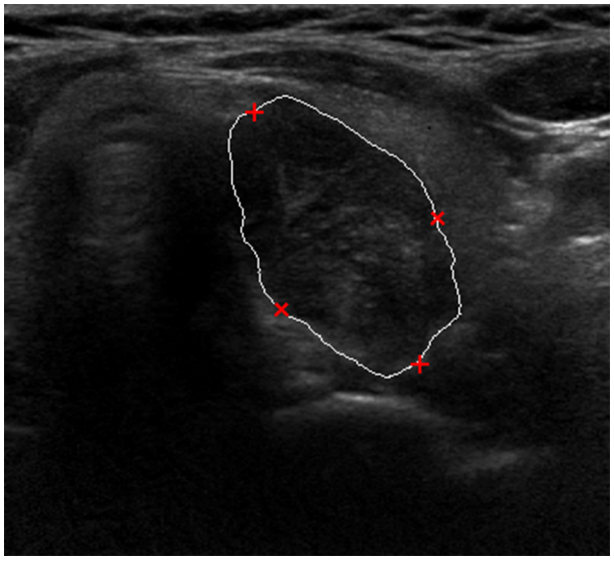

Figure 3 As soon as the two axes are defined, the contour is automatically generated by the computer-aided detection and diagnosis system.

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