بسم الله الرحمن الرحيم

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بقسم التوثيق الإلكتروني بمركز الشبكات وتكنولوجيا المعلومات دون أدنى مسئولية عن محتوى هذه الرسالة.

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M.D. DEGREE IN RADIODIAGNOSIS

Title:

ULTRASOUND GUIDED FINE NEEDLE ASPIRATION VERSUS NON-ASPIRATION TECHNIQUES IN THE EVALUATION OF SOLID THYROID NODULES AND THEIR DIAGNOSTIC EFFICACY COMPARED TO TISSUE HISTOPATHOLOGY

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Dedication

This work is dedicated to everyone who helped others in achieving their goals and making people life better, for all my dear professors and mentors who were great.

I dedicate this work to my respectful parents Prof. Dr. Hassan Heidar and Dr. Sohair Abo Raya the most beloved ones in my life, and my great siblings Yasmine, Sherif & Hossam, many thanks to my awesome wife Yasmine El Ebrashy for her continuous support and motivations, you were and still awesome, and thanks to our parents Prof. Dr. Ibrahim El Ebrashy and Prof. Dr. Maha Hossam for everything, and special dedication goes to my kids Hassan and Maha.

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List of abbreviations

FNC : Fine needle cytology

FNNAC : Fine needle non-aspiration cytology

FNAC : Fine needle aspiration cytology

TIRADS : Thyroid Imaging Reporting & Data system

ACR : American college of Radiology

NPV : Negative predictive value

PPV : Positive predictive value

INR : International normalized ratio

US : Ultrasound

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Abstract

Aim of study:

Comparison between the Fine needle Non-Aspiration Cytology (FNNAC) and Fine Needle Aspiration Cytology (FNAC) in acquiring ultrasound guided fine needle cytology (FNC) samples from solid thyroid nodules to determine the better technique, hence improving the sample quality aiming to decrease the number of unnecessary thyroidectomies.

Patients & methods:

48 patients with solid thyroid nodules included in this study according to TIRADS guidelines, 4 samples were obtained for each nodule, 2 samples were obtained using FNNAC while the other 2 obtained using FNAC, samples were obtained by the same operator and evaluated blindly by the same pathologist according to the following criteria:

> Background blood, cellular yield, degree of cellular trauma, and cellular architecture, each criterion is evaluated by score from 1 to 3 where score 3 is the best and worst is 1, the total score is calculated for each sample and used for comparison of the sample quality.

Results:

Prospective study showed statistically significant increase in cellular yield, preservation of cellular architecture and decrease in cellular trauma along with statistically significant increase in total sample quality with FNNAC (p value = 0.32, 0.004, 0.011, 0.21 respectively), and statistically insignificant difference in background blood in the sample (P value = 0.8). Regarding sample convenience, FNNAC was found to be more convenient for both the patient (syringe is not seen by the patient reducing discomfort) and for the operator (better handling of the needle and less maneuvers).

Conclusion:

FNC is an approved sensitive & cost-effective method to evaluate thyroid nodules, FNNAC technique was found to be more convenient for both the patient and the operator with significant improvement in sample quality compared to FNAC.

Introduction

Thyroid nodules are relatively common diseases of the endocrine system, with estimated prevalence about 34.2% by high-resolution ultrasound among randomly selected individuals with a female predominance. *(Moon J.H. et al.,2018).*

Among detected thyroid nodules whether by palpation or ultrasound, the estimated risk of malignant nodules is about 5-15%. *(Jiang H. et al., 2016).*

Fine – needle aspiration cytology (FNAC) for tumors was first described by Martin and Ellis in the year 1930 in the United States. *(Kaur D.S., 2014)*

Ultrasound guided fine needle cytology biopsy appeared to be a relatively accurate method to evaluate thyroid nodules even those larger than 3 cm, with false-negative rates of about 2%. However much larger series would be required to for evaluating its accuracy in nodules > 3 cm. *(Yoon J.H. et al., 2011)*

Fine needle cytology (FNC) is usually done for the indeterminate thyroid nodules being safe, accurate and cost-effective method of evaluating thyroid nodules, Ultrasound guidance allows direct visualization of the nodule with real time guidance for the needle to the desired location within the nodules, with good accuracy (80%). *(Parsa A.A. & Gharib H., 2019)*

Unsatisfactory specimens, especially mixed with blood, poses an obstacle in proper cytological interpretation. To overcome this problem, an alternative method of fine needle non-aspiration cytology (FNNAC) technique was developed which relies on the capillary pressure only to suck the cells inside the needle bore. *(Sasikumar M.N. et al., 2018)*

FNNAC also known as cytopuncture was developed in France in 1982 by Brifford et al., originally was developed for vascular organs to avoid hemorrhage

and to obtain less hemorrhagic cytology samples from breast lesions. *(Kaur D.S., et al., 2014)*

FNNAC depends on insertion of a fine needle into the lesion without attaching a syringe, depending on the capillary principle of the needles that states that a fluid or semi-fluid material will ascend spontaneously in a tube (in inverse proportion to the tube diameter), without active suction or aspiration leading to less trauma to samples. *(Brifford M., et al., 1982)*

Nondiagnostic results and sensitivity are still the major challenges of FNC procedure. Despite high experiences, new aspiration and evaluation techniques, onsite cytopathology analysis and ultrasound guidance, up to 20% of initial aspirations may be nondiagnostic (Aysan E. et al., 2014).

Many non-invasive tools for evaluating the thyroid nodules were used, the most convenient and practical till now is the American thyroid association revised guidelines for management of thyroid nodules these guidelines were first described in 1996, then revised in 2009 and again in 2015 *(Haugen B.R., et al., 2016).*

These guidelines for active surveillance and management of thyroid nodules and differentiated thyroid cancer added a lot to the patients, as it led to more objective evaluation for the thyroid nodules, and decreased unnecessary fine needle cytology, and more importantly it decreased unnecessary thyroidectomies that were done and advised instead to stick to US criteria and use FNC as sensitive and accurate tool for evaluating suspicious nodules.

Our study will question the better technique for acquiring FNC from thyroid nodules; whether aspiration or non-aspiration technique, and as a secondary objective will evaluate the overall diagnostic efficacy of the FNC for evaluation of the thyroid nodules compared to tissue histopathology after thyroidectomy in the patient's group who underwent thyroidectomy (whether total or partial).

Aim of Work

Comparison between the Fine needle Non-Aspiration Cytology (FNNAC) and Fine Needle Aspiration Cytology (FNAC) in acquiring cytology samples from solid thyroid nodules to determine the better technique and determining the diagnostic efficacy of the fine needle cytology in evaluation of these nodules, aiming to decrease the number of unnecessary thyroidectomies.

Review of literature:

Anatomical considerations

Thyroid gland is the largest endocrine gland in the body, it is butterfly shaped residing in the antero-inferior compartment of the neck, it consists of 2 pyramidal shaped lobs joined together by the isthmus, in 50% of the population there's a small pyramidal shaped lobe seen extending from the mid-line of the isthmus to the root of the tongue and represents remnants of the thyroglossal duct called "*Pyramidal lobe*", it's significance remains in the fact that all pathological process occurring in the thyroid can also occur in the pyramidal lobe. *(Ranade, 2008)*

Thyroid gland is related anteriorly to the infra-hyoid muscles, laterally to the sternocliemastoid muscle & the carotid sheath medially to the trachea inferiorly and larynx superiorly while posteriorly it is related to the pre-vertebral fascia, the gland itself is covered by 2 layers of fibrous capsule.

Development of the thyroid gland:

The thyroid gland starts the development between 10^{th} to 12^{th} week of gestation and starts its function at 16^{th} week. It arises as a median thickening of the cells forming thyroid tissue at foramen cecum between anterior 2/3 and posterior 1/3 of the tongue at the floor of the pharynx, the Outgrowth of the foramen cecum gives origin to the thyroglossal duct, which descends to its destination at the lower part of the front of the neck. *(Sadler, 2018)*

The lower end of the thyroglossal duct forms the thyroid gland and its pyramidal lobe, thyroid tissue continues to migrate inferiorly and eventually comes to rest at the anterior aspect of the trachea in the root of the neck, and the remaining part of the duct regress and disappear gradually in the fetal life, consequently, the migration of thyroid tissue may be arrested anywhere along the embryological descent of the gland., sometimes remnants of the thyroglossal duct

may persist as a thyroglossal cyst or may open in the skin forming thyroglossal fistula. *(Sadler, 2018)*

Arrest of migration of the original thyroid cells forming the thyroid gland where they remain in the tongue may occur forming lingual thyroid, on the contrary thyroglossal duct may descend more to reach behind the sternum forming retrosternal thyroid or anywhere along the line of descends of the thyroglossal duct which gives aberrant thyroid gland, lastly, sometimes there are *no cells forming thyroid gland leading thyroid agenesis. (Sadler, 2018)*

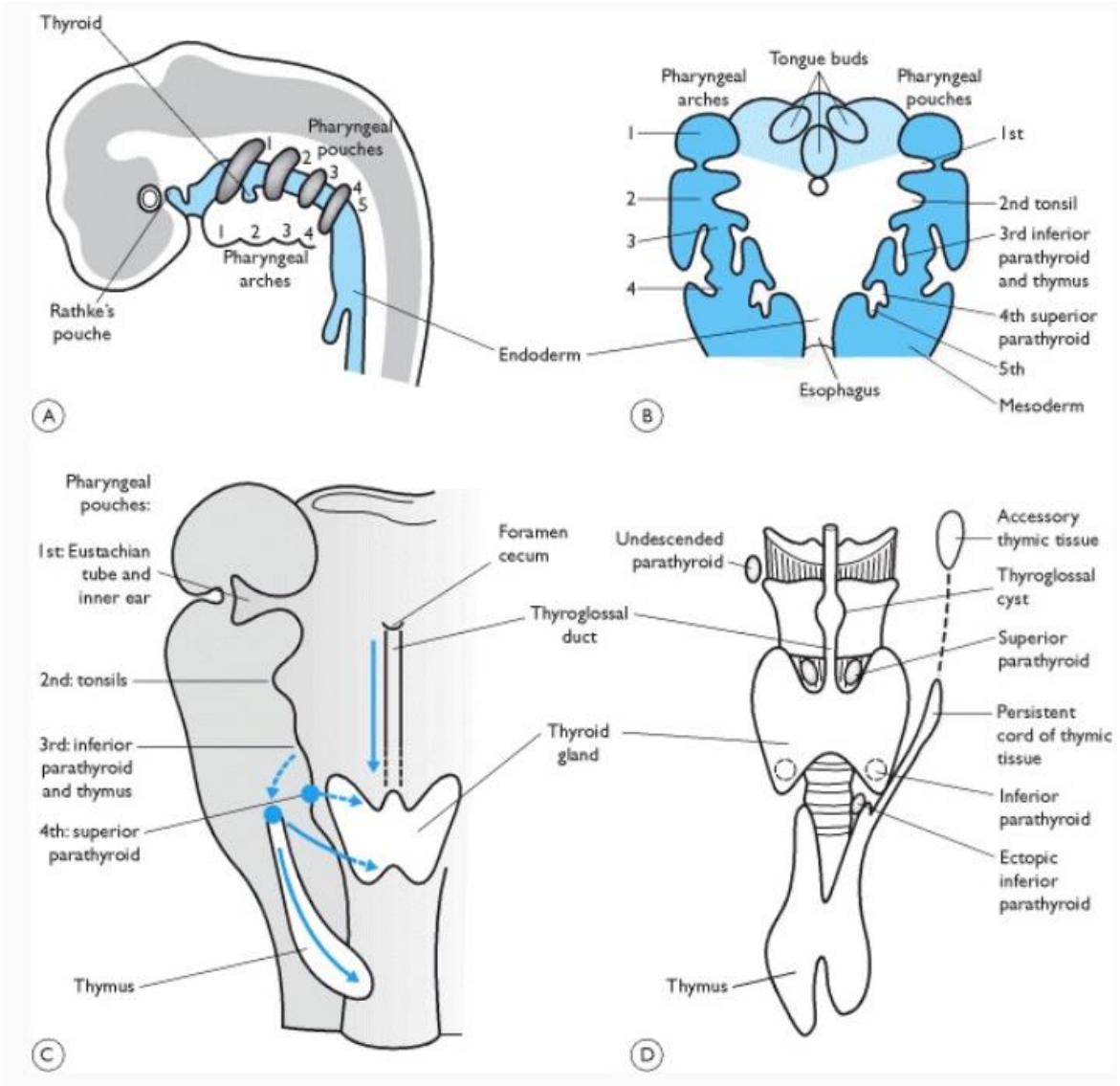

Figure 1: Diagrammatic illustration of the pharyngeal regions in human embryo during 5th week gestation, (a) sagittal (B) transverse views, showing the