The Diagnostic accuracy of Ultrasound Guided Fine Needle Aspiration Biopsy for Dominant Nodules in Multinodular Goiter

Thesis

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Ahmed Mohamed Rushdi

بسم الله الرحمن الرحيم

﴿وَعَلَّمَكَ مَا لَمْ تَكُنْ تَعْلَمُ وَكَانَ فَضْلُ اللهِ عَلَيْكَ عَظِيمًا﴾

صدق الله العظيم
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List of Contents

List of Tables

List of Figures

List of Figures Cont...

List of Abbreviations

Abb.	Full term
^{99}Tc	*Technetium pertechnetate*
AACE	*American Association of Clinical Endocrinologists*
ATA	*American Thyroid Association*
AUS	*Atypia of undetermined significance*
CGRP	*Calcitonin gene related peptide*
CNB	*Core needle biopsy*
CT	*Computed tomography*
EBSLN	*External branch of the superior laryngeal nerve*
EGF	*Epidermal growth factor*
FDG	*Fluorodeoxyglucose*
FLUS	*Follicular lesion undetermined significance*
FN	*Follicular neoplasm*
FNAC	*Fine-needle aspiration cytology*
H&E	*Hematoxylin and eosin*
IBSLN	*Internal branch of the superior laryngeal nerve*
IGF-1	*Insulin-like growth factor-1*
ITA	*Internal thoracic arteries*
ITC	*Insular thyroid cancer*
LGT	*Levator glandulae thyroideae*
MEN	*Multiple endocrine neoplasia*

List of Abbreviations Cont...

Abb.	Full term
MIFC	*Minimally invasive follicular carcinoma*
MNG	*Multinodular goiter*
MNGs	*Multinodular goiters*
MRI	*Magnetic resonance imaging*
MTC	*Medullary thyroid carcinoma*
NMTC	*Non-medullary thyroid carcinoma*
PTC	*Papillary thyroid carcinoma*
RLN	*Recurrent laryngeal nerve*
SCN	*Solid cell nests*
SFN	*Suspicious for a follicular neoplasm*
SLN	*Superior laryngeal nerve*
TE	*Tracheoesophageal*
TNF-alfa	*Tumour necrosis factor-alpha*
TSH	*Thyroid stimulating hormone*
US	*Ultrasonography*
WHO	*World health organization*
WIFC	*Widely invasive follicular carcinoma*

INTRODUCTION

Thyroid nodule is a discrete lesion in the thyroid gland that is radiologically distinct from the surrounding thyroid parenchyma ***(Haugen et al., 2016).***

Thyroid nodules are common; their prevalence in the general population is high, the percentages vary depending on the mode of discovery: 2–6 % (palpation), 19–35 % (ultrasound) and 8–65 % (autopsy data) ***(Dean and Gharib, 2008).***

They are discovered either clinically on self-palpation by a patient, or during a physical examination by the clinician or incidentally during a radiologic procedure such as ultrasonography (US) imaging, computed tomography (CT) or magnetic resonance imaging (MRI) of the neck, or fluorodeoxyglucose (FDG) positron emission tomography. With the increased use of sensitive imaging techniques, thyroid nodules are being diagnosed incidentally with increasing frequency in the recent years ***(Li et al., 2013).***

Multinodular goiter (MNG) is defined as the palpation of multiple discrete nodules in the enlarged thyroid gland. Etiology and pathogenesis of MNG is not very clear. A mild dietary deficiency of iodine, slight impairment of hormones synthesis, increased iodide clearance from the kidney and presence of thyroid stimulating immunoglobulins have been suggested as the various causes ***(Memon et al., 2004).***

MNG is a risk factor for epidemiologically ascertained thyroid malignancy. Epidemiologically studies have demonstrated the incidence of malignancy in patient with MNG was higher than the incidence of general population ***(Sarda and Kapur, 2005).***

Traditionally patients with MNG have been considered less at risk of malignancy than those with single nodule. However, published reports show that the incidence of malignancy in patients with single nodule dose not differ from those with MNG ***(Rios et al., 2005).***

Initial assessment of a patient found to have a thyroid nodule either clinically or incidentally should include a detailed and relevant history plus physical examination. Laboratory tests should begin with measurement of serum thyroid-stimulating hormone (TSH). Thyroid scintigraphy/radionuclide thyroid scan should be performed in patients presenting with a low serum TSH ***(Haugen et al., 2016).***

Comprehensive history with focus on risk factors predicting malignancy should be part of the initial evaluation of a patient with thyroid nodule. Symptoms of hypothyroidism or hyperthyroidism should be assessed. Patients should be questioned about local pressure symptoms such as difficulty in swallowing or breathing, cough and change in voice ***(Gharib et al., 2016).*** (Table 1)

Table (1): Increased risk of malignancy in thyroid nodule on history and physical exam ***(Gharib et al., 2016).***

▪ History of childhood head/neck irradiation
▪ Total body irradiation for bone marrow transplantation
▪ Exposure to ionizing radiation from fallout in childhood or adolescence
▪ Family history of PTC, MTC, or thyroid cancer syndrome (e.g., Cowden's syndrome, familial polyposis, Carney complex, multiple endocrine neoplasia [MEN] 2, Werner syndrome)
▪ Enlarging nodule/rapid nodule growth
▪ Cervical lymphadenopathy
▪ Fixed nodule to surrounding tissue
▪ Vocal cord paralysis/hoarseness

Imaging studies

Radionuclide thyroid scan/scintigraphy

Scintigraphy, a diagnostic test used in nuclear medicine, utilizing iodine radioisotopes (more commonly used; usually ^{123}I) or technetium pertechnetate (^{99}Tc), measures timed radioisotope uptake by the thyroid gland. The uptake of the radioisotopes will be greater in hyperfunctioning nodule and will be lower in most benign and virtually all malignant thyroid nodules than adjacent normal thyroid tissue ***(Reschini et al., 2006).***

Thyroid sonography/ultrasound

Thyroid ultrasound should be performed in all those suspected or known to have a nodule to confirm the presence of a nodule, evaluate for additional nodules and cervical lymph

nodes and assess for suspicious sonographic features. The next step in the evaluation of a thyroid nodule, if they meet the criteria as discussed later, is a fine needle aspiration (FNAC) cytology ***(Castro and Gharib, 2005).***

The recent ATA guidelines classify nodules into 5 risk groups based on US results. However, the current AACE guidelines suggest a more practical, 3-tier risk classification: low risk, intermediate risk and high risk thyroid lesions, based on their US characteristics ***(Gharib et al., 2016).***

The nodular characteristics that are associated with a higher likelihood of malignancy include a shape that is taller than wide measured in the transverse dimension, hypoechogenicity, irregular margins, microcalcifications, and absent halo ***(Remonti et al., 2015).***

The feature with the highest diagnostic odds ratio for malignancy was suggested to be the nodule being taller than wider. The more suspicious characteristics that the nodule has, it increases the likelihood of malignancy. In contrast, benign nodule predicting US characteristics include purely cystic nodule (< 2 % risk of malignancy) spongiform appearance (99.7 % specific for benign thyroid nodule) ***(Brito et al., 2014).***

AIM OF THE WORK

The aim of this study is to discuss the accuracy of Ultrasound guided FNAC technique in diagnosis of pathological types of dominant nodule in multinodular goiter.

Chapter One

ANATOMY AND HISTOLOGY

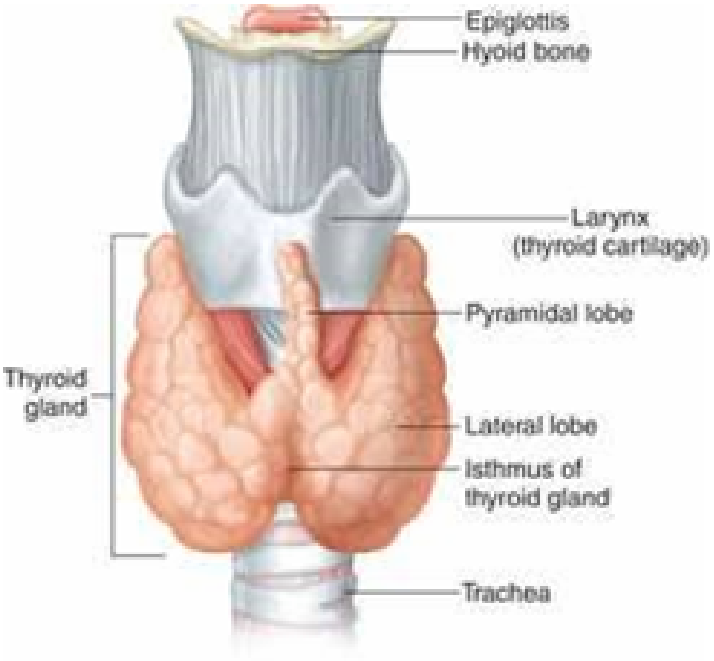

Figure (1): Anatomy of thyroid gland ***(Patton and Thibodeau, 2010).***

Embryology of thyroid gland

The development of thyroid gland begins by the third week of gestation and ends by the eleventh week. The primordium of the medial part of the thyroid gland appears during the third week of gestation as an epithelial proliferation in the floor of the pharynx immediately caudal to the tuberculum impar at the border of the first and second pharyngeal pouches ***(Sadler and Langman, 2006).***