



Utilizing the McGill Thyroid Nodule Score to compare between hemithyroidectomy cases who required completion thyroidectomy and cases of hemithyroidectomy alone

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ARTICLE INFO

Keywords:

McGill Thyroid Nodule Score
Indeterminate nodule
Thyroid cancer
Fine-needle aspiration biopsy

ABSTRACT

Objectives: This study aims to evaluate whether the McGill Thyroid Nodule Score (MTNS) accurately helps to decide the extent of surgery (hemithyroidectomy versus total thyroidectomy) based on the malignancy risk and to assess whether its use lowers the rate of completion thyroidectomy in cases of indeterminate thyroid nodules.

Methods: We performed a retrospective cohort study comparing MTNS results of patients undergoing hemithyroidectomy in King Abdulaziz Medical City, NGH, Jeddah from the period of January 2013 to December 2017. We divided the cases into hemithyroidectomy who required completion and hemithyroidectomy who did not need completion surgery. The pre-operative indeterminate FNA biopsy subgroup comprised of Bethesda type III (atypia of undetermined significance/follicular lesion of undetermined significance) and Bethesda type IV (follicular neoplasm/suspicious for a follicular neoplasm/Hurthle cell neoplasm). Post-operative histopathology was divided into benign or malignant groups.

Results: Of the 501 patient charts reviewed, 111 (22.2%) had an indeterminate FNA biopsy. 97 (87.4%) patients were females and 14 (12.6%) were males. In the hemithyroidectomy group, the pre-operative mean of the MTNS was 6.65, while in the completion thyroidectomy the mean was 11.47. The median MTNS was 7 (32% risk of malignancy) for the hemithyroidectomy group and 11 (63% risk of malignancy) for the completion thyroidectomy group ($p < 0.001$).

Conclusions: Based on the MTNS the risk of malignancy in cases of hemithyroidectomy who required completion surgery was significantly higher than those who underwent hemithyroidectomy only. The MTNS can be of value to thyroid surgeon in the pre-operative decision-making when dealing with an indeterminate thyroid nodule on FNA biopsy.

1. Introduction

Thyroid cancer is the most common endocrine malignancy. Its incidence has been steadily increasing over the last four decades [1,2]. It is now considered the fastest growing cancer concerning its incidence [2]. Data from the National Cancer Registry have shown a significant increase in the rate of Thyroid malignancy [3]. Thyroid malignancy is the second most common cancer in females after breast cancer and its incidence has also been increasing in males [3]. Thyroidectomy is the most commonly performed endocrine surgical procedure in the Kingdom of Saudi Arabia [4]. Ultrasound-guided fine needle aspiration biopsy (USFNA) is the first-line modality in the diagnostic workup of thyroid nodules [5]. Biopsy results are categorized into three main

groups: benign, malignant or indeterminate. The indeterminate result that accounted for 15% to 48% of thyroid nodule biopsies is challenging regarding diagnosis and management [6]. The McGill Thyroid Nodule Score (MTNS) was developed to estimate the malignancy risk of a thyroid nodule. This scoring system combines patient history, demographics, imaging and FNA results [7]. Each of the 22 variables in the MTNS is assigned a weighted, relative point score based on the robustness of the current supporting evidence for that risk factor as demonstrated in Fig. 1. The MTNS has been shown to correlate with the malignancy risk in a large series of patients [7]. Completion thyroidectomy may be necessary when the diagnosis of malignancy is made following hemithyroidectomy for an indeterminate biopsy. All patients with thyroid cancer except low-risk tumors as those with small lesions,

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McGill Thyroid Nodule Score

Clinical Parameters & Labs		Points	
1. Gender	male	1	_____
2. Age	> 45 yr	1	_____
3. Palpable nodule	present	1	_____
4. TSH levels	TSH > 1.4 mIU/L	1	_____
5. Consistency	stone/bone hard	2	_____
6. Ionizing radiation exposure	present	3	_____
7. Family history of thyroid cancer	present	3	_____
8. Ethnicity (Filipino, Hawaii, Iceland)	present	3	_____
Ultrasound & PET Scan			
1. Echogenicity	hypochoic	1	_____
2. Increased vascularity	present	1	_____
3. Shape	taller than wide	1	_____
4. Calcifications	coarse calcifications	1	_____
	microcalcifications	2	_____
5. Enlarging	More than 10%	1	_____
	More than 30%	2	_____
6. Lymphadenopathy	present	2	_____
7. Size	2–2.9 cm	2	_____
	3–3.9 cm	3	_____
	4 cm or greater	4	_____
8. PET scan focally positive	present	4	_____
Cytology			
1. Hürthle cell lesion	present	2	_____
2. Favour neoplasm	present	3	_____
3. Atypia (not reactive)	mild	3	_____
	moderate	4	_____
	severe/significant	5	_____
4. Suspicious for malignancy	present	7	_____
5. HBME-1	positive	7	_____
6. <i>BRAF</i> mutation (molecular analysis)	present	7	_____

<i>Score Interpretation (risk of malignancy)</i>		
0 – 0%	8 – 39%	14–18 – 93%
1–3 = 27%	9–11 = 63%	> 19 = 100%
4–7 = 32%	12–13 = 88%	

Fig. 1. The McGill Thyroid Nodule Scoring Template (MTNS). PET, positron emission tomography; TSH, thyroid stimulating hormone.

intrathyroidal, unifocal, and node-negative [8]. Variation in thyroid cytology provision may be the crucial factor that increases the rates of completion thyroidectomy [9]. Recurrent laryngeal nerve paralysis and hypoparathyroidism are the most common and feared complications in completion thyroidectomy. Also, the risk of permanent hypothyroidism is more in the patients who underwent completion thyroidectomy [10]. Thyroid surgeon should be aware of how to minimize the need for re-operative thyroid surgery and strictly adhere to detailed preoperative work-up and individual risk assessment before the surgical decision [11]. McGill Thyroid Nodule Score (MTNS) can be used as a tool to guide management of indeterminate risk thyroid nodules. This study aims to assess the accuracy of the MTNS in predicting the rate of thyroid malignancy pre-operatively and thus doing the appropriate surgery for the patient and minimizing the need for completion surgery.

2. Methods

We performed a retrospective review of 501 consecutive patients who underwent hemithyroidectomy at the Section of Otolaryngology-Head and Neck Surgery, King Abdulaziz Medical City, Jeddah from the period of January 2013 to December 2017. The study received approval

from the institutional review board (IRB) of King Abdullah International Medical Research Center (KAIMRC). In our center, the pathologist performed Most of FNA biopsies in the pathology department. FNA biopsies under ultrasound (US) guide were done if the nodule was not clinically palpable or the suspicious lesion is difficult to be done without US guide, or the previous result was not satisfactory. The patients were divided into three groups based on the pre-operative FNA results: benign (Bethesda type II), indeterminate (Bethesda types III-IV), and suspicious for malignancy/malignant (Bethesda types V-VI). The study included only cases of indeterminate (Bethesda types III-IV) results that underwent either hemithyroidectomy alone or completion post hemithyroidectomy. In all cases of completion thyroidectomy, the malignancy post hemithyroidectomy was the main issue. Of note, patients with an indeterminate FNA biopsy who did not undergo surgery were excluded from the study. Missing data were excluded from the study. The median and the mean of MTNS scores were calculated for each group to determine if the MTNS can predict the malignancy risk in cases of indeterminate FNA results. We divided the postoperative results into benign and malignant based on the permanent histopathology. MTNS and post-operative histopathology were noted for each patient. Data were collected and analyzed using the Statistical

Table 1
The Bethesda System for reporting thyroid cytopathology.

Bethesda diagnostic category	n %
I. Nondiagnostic/unsatisfactory	14 (2.8%)
II. Benign	169 (33.7%)
III. AUS or FLUS	50 (10%)
IV. FN or SFN or HN	61 (12.2%)
V. Suspicious for malignancy	63 (12.6%)
VI. Malignant	144 (28.7%)

AUS, atypia of undetermined significance; FLUS, follicular lesion of undetermined significance; FN, follicular neoplasm or suspicious for follicular neoplasm; HN, Hurthle cell neoplasm.

Package for Social Sciences Version 21.0 (SPSS Inc., Chicago, IL, USA). For comparative analysis, we used Pearson Chi-square and Independent Sample Student *t*-test. All tests were two-tailed and the *p*-value of < 0.05 was considered significant.

3. Results

According to the Bethesda System for reporting thyroid FNA biopsies, 111/501 (22.2%) was indeterminate lesions. The details of other lesions were demonstrated in Table 1. 97 (87.4%) patients of the indeterminate group were females and 14 (12.6%) were males. Their age ranged from 10 to 89 years. The mean patient age (\pm SD) was 42.6 \pm 15.5 years. 58/111 (52.3%) of the patients underwent hemithyroidectomy and 53 (47.7%) underwent completion thyroidectomy. In the hemithyroidectomy group, the median of the MTNS was 7.00 while in completion thyroidectomy group was 11.00. The mean of the MTNS was 6.65, while in the completion thyroidectomy group the mean was 11.47. The details of MTNS of each surgical procedures were demonstrated in Table 2. Statistically there was a significant difference between the MTNS mean and median of the patients diagnosed as benign pathology after hemithyroidectomy and the MTNS mean and median of the patients who diagnosed as malignancy post hemithyroidectomy and therefore need completion surgery (*p* = 0.001) (see Table 3).

4. Discussion

FNA is an integral part in the work-up of thyroid nodules [5]. When an FNA biopsy indicates an indeterminate result, the risk of malignancy is often uncertain and not all indeterminate nodules are malignant [6]. Sugino et al. documented a 28% incidence of malignancy in their indeterminate lesions [12]. Tutuncu et al. reported an incidence of 23% and 33.3% for malignancy in follicular lesions and Hurthle cell lesions and, respectively [13]. There is no consensus about performing surgeries for indeterminate lesions. In the literature up to 74% of patients with indeterminate nodules undergo surgery mainly due to the limitations of FNA [6,14]. The risk of malignancy needs to be weighed against the risk of serious surgical complications such as recurrent laryngeal nerve injury, hypocalcemia, as well as the lifelong need for thyroid

Table 2
MTNS scores of each subgroup of patients.

MTNS	Hemithyroidectomy (n = 58)	Completion thyroidectomy (n = 53)	Malignancy risk %
1-3	12	0	27
4-7	25	2	32
8	11	3	39
9-11	9	21	63
12-13	1	13	88
14-18	0	13	93
> 19	0	1	100

MTNS, McGill Thyroid Nodule Score.

Table 3
Median and mean MTNS scores of each subgroup of patients.

Surgical procedure	Median MTNS (mean)	Estimated malignancy risk %	<i>p</i> value
Hemithyroidectomy (n = 58)	7 (6.65)	32	0.001
Completion thyroidectomy (n = 53)	11 (11.47)	63	

hormone replacement [15]. Our study shows that 22.2% of patients with pre-operative FNA results are indeterminate pathology (Bethesda III and IV). In the literature, the rate of indeterminate nodules is variable and reported as high as 57% [6]. The use of HBME staining in some pathology centers, the heterogeneity of their characteristics and subjectivity in the diagnostic criteria can explain the wide range of variability in the literature [16,17]. The high frequency of indeterminate nodules and the significant incidence of malignancy within this group reinforce the need for ancillary tools including specific genetic markers to help guide management [6]. It is a challenge in such pathology the decision when you need to perform surgery and the proper type of the surgical procedure. Thus, it was appropriate to utilize a comprehensive scoring system when assessing malignancy risk to guide clinical management of indeterminate lesions. Among few thyroid nodule scores in the literature, we found McGill Thyroid Nodule Score (MTNS) is the most comprehensive scoring system that encompassed the diagnostic indices of each of the currently recognized clinical, radiologic, and pathologic risk factors for thyroid carcinoma [7]. It was developed by a multidisciplinary committee at the McGill University. This non-validated scoring system uses evidence-based risk factors for thyroid cancer to estimate the malignancy risk. The MTNS is based on risk factors for thyroid cancer categorized into eight clinical/laboratory parameters, eight imaging features (ultrasound/positron emission tomography scan) and six pathological criteria. These risk factors are based on the American Thyroid Association guidelines as well as a literature review on thyroid malignancy risk factors. Sands et al. demonstrated a PPV and specificity for carcinoma of 66% and 13% for scores > 4, 81% and 66% for scores > 8, 96% and 96% for scores > 14 and 100% for scores > 19, respectively [6,7]. In our study which focused on the indeterminate FNA results (Bethesda type III and IV), the median MTNS for all patients who underwent hemithyroidectomy was 7 (32% risk of malignancy) and 11 for patients who underwent completion thyroidectomy (63% risk of malignancy). Varshney R et al. demonstrated in cases of MTNS of 7; a diagnostic hemithyroidectomy would be the therapeutic option chosen. With MTNS of 9, a higher risk of thyroid cancer likely exists [6]. In such cases, a discussion with patients about the utility of a total thyroidectomy may be advocated, precluding the need for completion thyroidectomies in cases of malignancy. Despite this, it remains unclear of the significance of an indeterminate USFNA with a MTNS score of 8 [6]. There are certain factors including a retrospective type of the study and subjectivity in the counting MTNS limit the generalization of this study. In addition, not all patients seen at our institution have a calculated MTNS, resulting in patients being excluded from analysis. Modern diagnostic tests to help direct the need for and extent of surgery, particularly in patients with indeterminate results are needed. Furthermore, validated risk stratification algorithms, similar to the MTNS, are useful in the counseling and management until such tests are widely available.

5. Conclusion

Our study shows that when facing cases of indeterminate thyroid nodules, the MTNS can demonstrate an increased pre-operative risk of carcinoma for nodules found to be malignant. We suggest that the MTNS can be used as a tool to guide the management of indeterminate thyroid nodules, as it helps to choose the proper surgery and limit the

need for completion and second surgery. It also clarifies communication between physicians and patients.

Declaration of competing interest

Authors have no conflict of interests, and the work was not supported or funded by any medical company.

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