Comparative study between cytological and histopathological analysis results of hemithyroidectomy in treatment of solitary thyroid nodule

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Aim
The aim of this study was to compare the outcome results of cytological examination by fine-needle aspiration cytology to histopathological examination by hemithyroidectomy in patients with solitary thyroid nodule.

Patients and methods
We prospectively reviewed 30 consecutive patients had primary hemithyroidectomy for management of solitary thyroid nodule, carried out over a year (from January 2017 to January 2018) at Assiut University Hospital Surgical Department.

Results
There were 24 women and six men with a mean age 34.67 years (range, 19–70 years). Preoperative findings of fine-needle aspiration cytology of these were: 17 (56.7%) patients had colloid nodule, 10 (33.3%) follicular neoplasm, and three3 (10%) hyperplastic nodule. Biopsied lesions were found to be malignant on pathological evaluation in two (6.6%) patients with follicular neoplasm, hemithyroidectomy was adequate definitive treatment in 28 of 30 (93.3%) patients.

Conclusion
In a review of the experience at Assiut University Hospital Surgical Department, hemithyroidectomy was the optimal initial and definitive surgical approach for most patients with benign and indeterminate cytology and had undergone thyroid surgery for suspicion of cancer.

Keywords:
fine-needle cytology, follicular neoplasm, hemithyroidectomy

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Background

The thyroid nodule refers to an abnormal growth of thyroid cells that forms a lump within the thyroid gland. Although the vast majority of thyroid nodules are benign, a small proportion of thyroid nodules contain thyroid cancer. In order to diagnose and treat thyroid cancer at the earliest stage, most of thyroid nodules need some type of evaluation. Often these abnormal growths of thyroid tissue are located at the edge of the thyroid gland, so they can be felt as a lump in the front of neck. When they are large or when they occur in very thin individuals, they can even sometimes be seen as a lump in the front of the neck [1].

Thyroid nodules are more common in women than in men, its incidence in females is about one in 12–15 young women has a thyroid nodule, but in males is about one in 40 young men has a thyroid nodule. More than 95% of all thyroid nodules are benign (noncancerous growths). Some are actually cysts, which are filled with fluid rather than thyroid tissue. The incidence of thyroid nodules increases with age. Thyroid nodules may be present in 20% or more of adults subjected to routine thyroid echography [2,3].

The development of management strategy involves the integration of information from a variety of possible sources including history, clinical examination, biochemical assessment, and spectrum of additional investigations. Ultrasonography of the thyroid gland is used in differentiating the true solitary thyroid nodule from those with multinodular gland. Also it classifies the nodule into solid, cystic, or mixed. However it admit a little help in determining the pathological types of the nodule [4].

Fine-needle aspiration cytology (FNAC) has become the corner stone investigation. Unfortunately, on the basis of cytological characteristic alone, the pathologist cannot reliably distinguish benign from malignant follicular thyroid lesions, ~20% of FNACs will be given

a final diagnosis of follicular malignancy. For benign solitary nodule hemithyroidectomy of the involved lobe is recommended and not total thyroidectomy, but in treating suspicious and false-negative (FN) FNAC reports could be overcome by total thyroidectomy [5].

Hemithyroidectomy with or without isthmusectomy is performed as the initial operation for patients with an indeterminate cytological diagnosis and no clinical evidence of regional or distant metastatic disease or any other concurrent indication for total thyroidectomy. If gross extrathyroidal tumor extension or lymph node metastasis is found at the time of operation, a total thyroidectomy is then carried out [6].

Patients and methods

This study was performed at General Surgery Department, Assiut University Hospitals, from January 2017 to January 2018. A total of 30 patients (34.67 ± 13.62 years; 80% women) with symptomatic solitary thyroid nodule were included. Ethical approval 17100803.

Inclusion criteria

(1) Adult male or female patient with solitary thyroid nodule
(2) Presence of pressure symptoms or cosmetic problems
(3) Patients presented with benign lesion or follicular neoplasm confirmed by FNAC examination
(4) Serum levels of thyroid hormones within normal limits
(5) Written consent, free, and informed.

Exclusion criteria

(1) Contraindications for general anesthesia
(2) Patient with multinodular goiter
(3) Fine-needle aspiration positive for malignancy.

Preoperative assesment

Detailed history

Either toxic symptoms (palpitation, nervousness, insomnia, loss of weight in spite of good appetite), cosmetic (disfigurement), infiltrating symptoms (otalgia, change voice), or pressure symptoms (dysphagia, dyspnea).

Physical examination

(1) Generally: include the body built, pulse, and blood pressure
(2) Eye manifestation: lid lag, spasm of upper eyelid revealing the sclera above the corneoscleral limbus, and a prominent stare
(3) Locally: inspection, palpation, percussion, and auscultation with the aim to determine the following:
    (a) Size of the nodule, number (solitary or dominant), and its consistency
    (b) Signs of fixation to surround structures
    (c) Presence of palpable thrill or heard murmur.

Investigations

(1) Thyroid function test
(2) Preoperative investigation:
    (a) Complete blood picture
    (b) Prothrombin time and concentration
    (c) Blood urea and creatinine.

Neck ultrasound: to asses thyroid gland and detect any abnormality and lymph node enlargement.

Fine-needle aspiration cytology

Fine-needle aspiration is performed with a small-gauge needle (23–27 G) and may be performed with capillary or suction technique and ultrasound guided. Results of fine-needle aspiration biopsy reported using the Bethesda System for Reporting Thyroid Cytology [7].

Preoperative laryngoscopy: for assessment of vocal cord mobility.

Intraoperative management

Hemithyroidectomy operation during which we preserve the other lobe of thyroid gland beside excision the lobe contains the nodule and the isthmus.

Postoperative management

During the postoperative period of the patient were assessed for the clinical symptoms and signs of hypocalcaemia, respiratory difficulties, any change in voice or choking. Also close observation of the drain fluid, for example bloody and lymph discharge.

Histopathological examination of the removed specimen

Histopathology of the removed specimen will estimate the accuracy of the management, clinical data, and all investigation done.

Results

This study included 30 patients with symptomatic thyroid nodule, including 24 (80%) female patients

and six (20%) male patients. Overall, 13 patients were aged less than 30 years, nine patients were aged 30 to less than 40 years, and eight patients were older than 40 years, with mean age of 34.67 ± 13.62 years, as shown in Tables 1 and 2.

Findings on neck ultrasonography of the studied patients

All the patient had solitary thyroid nodule, 20 (66.7%) patients had right-side nodule while 10 (33.3%) patients had left-side nodule, size of the nodule (according to ultrasound measurement) was variable, seven (23.3%) patients had size of the nodule (<2 cm), nine (30%) patients had size of the nodule (2–3 cm), and 14 (46.7%) patients had size of the nodule (>3 cm).

Ten (33.3%) patients had enlarged lymph nodes of benign featuring and two (6.6%) patients had retrosternal extension (Table 3).

Findings of fine-needle aspiration cytology in the current study

Out of 30 patients included in the study, FNAC was done in all patient (100%) patients. Colloid nodule 17 (56.7%) patients while hyperplastic nodule three (10%) patients, follicular neoplasm 10 (33.3%) patients, respectively (Table 4).

Type of thyroidectomy in the current study

Hemithyroidectomy was performed in 30 (100%) patients, right-side hemithroidectomy in 20 (66.7%) patients and left-side hemithroidectomy in 10 (33.3%) patients lobectomy with isthmusectomy, respectively (Table 5).

Histopathological findings in the study

The most frequent findings in the histopathological findings in the current study was colloid and follicular adenoma occurred in 17 (56.7%) and nine (30%) patients, respectively. Follicular variant of papillary carcinoma presented in two (6.6%) patients, and hyperplastic nodule in only one (3.3%) patient and hashimoto's thyroiditis only one patient, respectively (Table 6).

Postoperative status and complications in the current study

Complications postoperatively were hoarseness of voice in three patients out of them; one (3.3%) patient due to temporary unilateral recurrent laryngeal nerve injury and the other two (6.6%) patients due to laryngeal edema, and temporary hypocalcaemia in one (3.3%) patient (Table 7).

Table 1 Sex distribution of the studied patients

Sex	*n* (%) (*n*=30)
Male	6 (20.0)
Female	24 (80.0)

Table 2 Age distribution of the studied patients

Age (years)	*n* (%) (*n*=30)
<30	13 (43.3)
30-40	9 (30.0)
>40	8 (26.7)
Mean±SD	34.67±13.62
Range	19.0-70.0

Table 3 Findings on neck ultrasonography of the studied patients

Findings	Number of cases [*n* (%)]
Single nodule	30 (100)
Right	20 (66.7)
Left	10 (33.3)
Size of the nodule (cm)	
<2	7 (23.3)
2-3	9 (30)
>3	14 (46.7)
Presence of lymphadenopathy	10 (33.3)
Presence of retrosternal extension	2 (6.6)

Table 4 Preoperative findings of fine-needle aspiration cytology in the current study

Preoperative FNAC	*n* (%) (*n*=30)
Colloid nodule	17 (56.7)
Follicular neoplasm	10 (33.3)
Hyperplastic nodule	3 (10)

FNAC, fine-needle aspiration cytology.

Table 5 Side of hemithyroidectomy

Side of operation	*n* (%) (*n*=30)
Right	20 (66.7)
Left	10 (33.3)

Table 6 Postoperative histopathology findings in the study

Postoperative histopathology	*n* (%) (*n*=30)
Colloid nodule goiter	17 (56.7)
Follicular adenoma	9 (30.0)
Follicular variant of papillary carcinoma	2 (6.7)
Hashimoto thyroiditis	1 (3.3)
Hyperplastic nodule	1 (3.3)

Table 7 Postoperative status and complications in the current study

Complications	*n* (%) (*n*=30)
RLN injury	1 (3.3)
Laryngeal edema	2 (6.6)
Hypocalcemia	1 (3.3)
No complication	26 (86.7)

RLN, recurrent laryngeal nerve.

Completion thyroidectomy posthemithyroidectomy

Completion thyroidectomy occurred in two cases in our study in which histopathological analysis results were follicular variant of papillary carcinoma. The two

cases had completion thyroidectomy of the other lobe within 2 weeks (Table 8).

Correlation between cytological and histopathological analysis results

There were three cases of FN had been reported as one case nodular goiter and two cases hyperplastic nodule by FNAC examination and there histopathological analysis was follicular adenoma. There were two cases of false positive (FP) diagnosis, diagnosed as follicular neoplasm by FNAC examination and there histopathological analysis show that one of them colloid nodular goiter and the other Hashimoto's thyroiditis (chronic lymphocytic thyroiditis). There were 17 cases true negative (TN), 16 cases were colloid nodule and one case hyperplastic nodule by FNAC examination and there histopathological assessment show 16 cases were colloid nodule and one case hyperplastic. There were eight true positive (TP) cases, all case were follicular neoplasm by FNAC examination, by histopathological analysis, six cases were follicular adenoma and two cases were follicular variant of papillary carcinoma (Table 9).

Overall performance of fine-needle aspiration cytology in diagnosis of thyroid neoplasm

Performance of FNAC in diagnosis of thyroid neoplasm calculated by sensitivity (72.7%), specificity (89.4%), accuracy (83.3%), positive predictive value (80%), and negative predictive value (89.4%) (Tables 9 and 10).

Discussion

This study was performed at General Surgery Department, Assiut University Hospitals, from January 2017 to January 2018. This work aimed to compare the outcome results of cytological examination by FNAC to histopathological examination by hemithyroidectomy in patients with solitary thyroid nodule. Mean age of the studied patients was 34.67 ± 13.62 years with range between 19 and 70 years. Out of 30 patients, 24 (80%) patients were females and six (20%) patients were males.

All patient show unilateral thyroid enlargement, 20 (66.7%) patient had right-side enlargement while 10 (33.3%) patient had left-side enlargement.

Preoperative assessment with neck ultrasound, thyroid function tests, laryngoscopy (for assessment of vocal cord mobility), and FNAC and postoperative histopathology of the spacemen is necessary. Preoperative assessment with cervical ultrasonography was done in all studied patients. All the patient had solitary thyroid nodule, size of the nodule (according to ultrasound measurement) was variable, seven (23.3%) patients had size of the nodule less than 20 mm, nine (30%) patients had size of the nodule 20–30 mm, and 14 (46.7%) patients had size of the nodule more than 30 mm. Ten (33.3%) patients had enlarged lymph nodes of benign featuring and two (6.6%) patients had retrosternal extension.

Brito and colleagues suggests that individual ultrasound featuring are not accurate predictors of thyroid cancer. Brito and colleagues searched diagnostic measures of ultrasonography. Total of 14 relevant ultrasound featuring were analyzed. Thirty-one studies between 1985 and 2012 were included (number of nodules 18 288, average size 15 mm). The frequency of thyroid cancer was 20%. The most common type of cancer was papillary thyroid cancer (84%). Estimates of accuracy depending on the physician interpreting the ultrasound, the type of cancer and nodule (indeterminate), and reference standard [8].

Preoperative FNAC was done in all (100%) patients; colloid nodule 17 (56.7%) patients while hyperplastic

Table 8 Completion thyroidectomy posthemithyroidectomy

Completion thyroidectomy	*n* (%) (*n*=30)
Yes	2 (6.7)
No	28 (93.3)

Table 9 Correlation between cytological and histopathological with true and false diagnosis of neoplasm

Cytological	Histopathological	Number of cases	True and false diagnosis	Total
Colloid nodule	Colloid nodule	15	TN	17
	Hyperplastic nodule	1	TN	
	Follicular adenoma	1	FN	
Hyperplastic nodule	Colloid nodule	1	TN	3
	Follicular adenoma	2	FN	
Follicular neoplasm	Colloid nodular	1	FP	10
	Hashimoto's thyroiditis	1	FP	
	Follicular adenoma	6	TP	
	Follicular variant of papillary carcinoma	2	TP	
Total		30		30

FN, false negative; FP, false positive; TN, true negative; TP, true positive.

Table 10 Overall performance of fine-needle aspiration cytology in diagnosis of thyroid neoplasm

Sensitivity	72.7%
Specificity	89.4%
Accuracy	83.3%
Positive predictive value	80%
Negative predictive value	89.4%

nodule three (10%) patients, follicular neoplasm 10 (33.3%) patients, respectively.

Hemithyroidectomy was performed in 30 (100%) patients, right-side hemithroidectomy in 20 (66.7%) patients and left-side hemithroidectomy in 10 (33.3%) patients lobectomy with isthmusectomy, respectively.

Wagana and colleagues agrees that hemithyroidectomy is the most common operation done in solitary thyroid nodule (81 operations were performed for solitary thyroid nodule, the most common operations were lobectomy and isthmectomy). They have done a retrospective review of all solitary thyroid nodules excised over a 3 years period from 1st January 1999 to 31st December 2001. A simple protocol was used to manage this condition involving history, clinical examination, fine-needle aspiration of the lesion, and excision was clinically indicated. Clinical diagnosis and operation was performed for the patients had solitary thyroid nodule over a 3-year period at Kijabe Hospital [9].

Complications postoperatively were hoarseness of voice in three patients out of them; one (3.3%) patient due to temporary unilateral recurrent laryngeal nerve injury and the other two (6.6%) patients due to laryngeal edema, and temporary hypocalcaemia in one (3.3%) patient.

Histopathological examination postthyroidectomy is mandatory. The most frequent findings in the histopathological findings in the current study were colloid and follicular adenoma occurred in 17 (56.7%) and nine (30%) patients, respectively. Follicular variant of papillary carcinoma presented in two (6.6%) patients, and hyperplastic nodule in only one (3.3%) patient, respectively.

Performance of FNAC in diagnosis of thyroid neoplasm calculated by numerous tests is available:

(1) TP = the number of cases correctly identified as having thyroid neoplasm
(2) FP = the number of cases incorrectly identified as having thyroid neoplasm
(3) TN = the number of cases correctly identified as not having thyroid neoplasm
(4) FN = the number of cases incorrectly identified as not having thyroid neoplasm
(5) Sensitivity measures the percentage of patient who are correctly identified as having thyroid neoplasm. Thus, sensitivity = TP/(TP + FN)
(6) Specificity measures the percentage of patient who are correctly identified as not having thyroid. Thus, specificity = TN/(TN + FP)
(7) Accuracy measures ability of fine-needle cytology to correctly identify the cases that having thyroid neoplasm and the cases that not having thyroid neoplasm. Thus, accuracy = (TP + TN)/(TP + FP + TN + FN)
(8) Predictive value positive is the proportion of positives that correspond to the presence of the thyroid neoplasm. Thus, predictive value positive = TP/(TP + FP)
(9) Predictive value negative is the proportion of negatives that correspond to the absence of the thyroid neoplasm. Thus, predictive value negative = TN/(TN + FN).

Correlation between FNAC and histopathological diagnoses and also shows the accuracy with which FNAC diagnosed malignancy. There were three cases of FN had been reported as one case nodular goiter and two cases hyperplastic nodule by FNAC examination and there histopathological analysis was follicular adenoma. Two cases of FP diagnosis, diagnosed as follicular neoplasm by FNAC examination and there histopathological analysis show that one of them colloid nodular goiter and the other Hashimoto's thyroiditis (chronic lymphocytic thyroiditis). There were 17 cases TN, 16 cases were colloid nodule, and one case hyperplastic nodule by FNAC examination and there histopathological assessment show 16 cases were colloid nodule and one case hyperplastic. There were eight TP cases, all case were follicular neoplasm by FNAC examination, by histopathological analysis, six cases were follicular adenoma and two cases were follicular variant of papillary carcinoma.

Comparing the latest study [10] with this study (2018), the number of patient 126, sensitivity 87.1%, specificity 64.6%, accuracy 77.3%, negative predictive value 79.5%, and positive predictive value 76.1% while this study number of patient 30, sensitivity 72.7%, specificity 89.4%, accuracy 83.3%, negative predictive value 80%, and positive predictive value 89.4%, respectively (Table 11).

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Nil.

Conflicts of interest
There are no conflicts of interest.

Table 11 Comparison of results of present study with previous studies

References	Number of patients	Sensitivity	Specificity	Accuracy	Negative predictive value	Positive predictive value
Al-Sayer *et al*. [11]	70	86	93	92	96	80
Cusick *et al*. [12]	283	76	58	69	64	72
Bouvet *et al*. [13]	78	93.5	75	79.6	88.2	85.3
Afroze *et al*. [14]	170	61.9	99.3	94.5	94.7	92.8
Ko *et al*. [15]	207	78.4	98.2	84.4	66.3	99
Al-Hureibi *et al* [16]	196	38	89.9	72	79.2	66.7
Kessler *et al*. [17]	170	79	98.2	87	16.6	98.7
Mahar *et al*. [18]	125	98	70	91	93	91
Haberal *et al*. [19]	260	92.6	91.6	91.9	96.5	83.5
Muratli *et al*. [10]	126	87.1	64.6	77.3	79.5	76.1
This study	30	72.7	89.4	83.3	80	89.4

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