Al-Azhar Med. J. *Vol. 49(2), April, 2020, 629-638*
DOI : 10.12816/amj.2020.69766
https://amj.journals.ekb.eg/article_69766.html

PREDICTORS OF A DIFFICULT THYROIDECTOMY

By

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ABSTRACT

Background: Thyroid surgery is one of the most common interventions in endocrine surgery. Thyroidectomy Difficulty Scale (TDS) was developed to identify more difficult operations, which correlate with long operative times, intraoperative problems and high complication rates.

Objective: To identify clinical, biochemical and pathological parameters this can predict difficult thyroidectomy preoperatively.

Patients and methods: This prospective study was randomized, non-interventional uncontrolled cross-sectional one. It was conducted on sixty patients. Those patients were already diagnosed to have thyroid disease needing thyroidectomy. Four items were used to score the difficulty of thyroid operations. Patient and disease factors were recorded for each patient. Difficult group and non-difficult groups were compared.

Results: A total of 60 patients were scored using that scale. Of them, 46 suffered from hyperthyroidism, 13 from Hashimotos, and 11 from thyroid cancer. Patients were with hyperthyroidism, level of antithyroglobulin antibodies for them was>4 IU/ml, and high thyroglobulin (>150 ng/mL) may associated with difficult thyroidectomy.

Conclusion: According to thyroidectomy difficulty scale, patients diagnosed as hyperthyroidism, increase of serum thyroglobulin, and antithyroglobulin antibodies preoperatively were associated with difficult thyroidectomy. This scale could assist surgeons in prediction of difficult operations and prepare for them.

Keywords: Thyroidectomy Difficulty Scale, thyroidectomy, Anti-thyroglobulin antibody, Hyperthyroidism, Hashimoto's thyroiditis.

INTRODUCTION

Thyroidectomy is one of the commonest surgeries performed worldwide. The difficulty of the procedure can be influenced by a variety of factors. In order to have a more objective measurement of difficulty, *Schneider and Colleagues (2014)* developed a "Thyroidectomy difficulty scale" (TDS). TDS is a four item (vascularity, friability, mobility/fibrosis, gland size), 20-point scale, in which each item is scored on a five-point scale. After thyroidectomy, the surgeons completed the TDS.

The main complications associated with thyroidectomy are injury to laryngeal nerves, and injury to parathyroid glands. As the thyroidectomy becomes more difficult, the incidence of these complications increases *(Schneider et al., 2014)*. Traditionally, conditions associated with difficult thyroidectomy include

hyperthyroidism and thyroiditis. However it is difficult to predict the level of difficulty in each individual case. If it is possible to predict a difficult thyroid surgery preoperatively, patients can be warned about the higher chance of complications and also the surgeon can be well prepared. The purpose of this study was to identify preoperative variables predicting a difficult thyroidectomy *(Mok et al., 2014).*

Hyperthyroidism, Graves's ophthalmopathy, preoperative thyroglobulin, and antithyroglobulin antibody were associated with a more difficult thyroidectomy. Identifying of these predictors of difficulty can aid in operative risk counseling, preoperative preparations and scheduling operating room time. It is essential to assess and adjust risk for specific procedures such as thyroidectomy, not just overall surgical complications. The TDS helps identifying these higher risk patients needing thyroidectomy. Within the study, a diagnosis of hyperthyroidism was independently associated with a more difficult thyroid operation and more complications *(Upile et al., 2011).*

The present work aimed to identify predicting factors that affect the difficulty of thyroidectomy which may associate with longer operative times and increase complications.

PATIENTS AND METHODS

This prospective study was randomized, non-interventional and uncontrolled cross-sectional one. It was inducted on sixty patients. Those patients were already diagnosed to have thyroid disease needing thyroidectomy. Those patients were from the outpatient clinics of General Surgery Departments, Al-Azhar University Hospitals. Thyroidectomy Difficulty Scale (TDS) was used after thyroid operations. The difficulty scale included four factors, i.e. vascularity, friability, mobility or fibrosis, and gland size. Each factor was graded on a scale from 1 to 5. One indicated minimal, and five indicated extensive involvement. A score of 20 indicated the most difficult thyroid surgery *(Schneider et al., 2014).*

Written informed consents from the patients and an approval of the study were obtained from Al- Azhar University Academic and Ethical Committee.

Patients underwent total thyroidectomy operation.

Inclusion Criteria:

- Patients aged 25-70 years or more.
- Patients have thyroid disease undergoing thyroidectomy.

Exclusion Criteria:

- Patients who underwent concomitant neck dissection, para thyroidectomy, or preoperative thyroidectomies.
- Thyroid cancer patients who underwent a central neck lymph node dissection.

All patients were subjected to the following:

- History taking and the symptoms.
- Clinical examination: Both generally and locally.

- Laboratory investigations: Thyroid function tests, serum calcium before and after the surgery, and fine needle aspiration cytology.
- Imaging techniques: U/S ± CT ± thyroid scan.
- Indirect laryngoscope before and after surgery.
- TIMES OF OPERATION: All operative times were standardized to each surgeon's average time. A relative time of one was equivalent to the surgeon's average time. If an operation took longer than the surgeon's average, the relative time would be >1. If an operation took less time than the surgeon's average, the relative time would be <1. The non-difficult group had an average relative time of 0.94 indicating most those patients' operations took less time than the surgeon's average operating time. The Difficult group patients had an average time of 1.15, indicating most DT patients' thyroidectomies took longer than the surgeon's average ($P < 0.01$).

Statistical analysis:

Results were collected, tabulated and statistically analyzed by an IBM compatible personal computer with SPSS statistical package version 20 (SPSS Inc. Released 2011. IBM SPSS statistics for windows, version 20.0, Armonk, NY: IBM Corp.).

Descriptive statistics was expressed in number (No), percentage (%), mean (X), and standard deviation (SD).

- Student's t-test was used for comparison of quantitative variables between two groups of normally distributed data, while Mann Whitney's test was used for comparison of quantitative variables between two groups of not normally distributed data.
- Chi 2 and Fischer's exact tests were used to compare qualitative data.
- P - Value of < 0.05 was considered statistically significant.

RESULTS

Age distribution: Patients were 25-70 years with standard deviation 45.1±15. Sex distribution: There were 14 (23.3%) males, and 46 (76.7%) females. 78.3% complained of Neck swelling, 10% complained of Toxic manifestation, 8.3% complained of difficulty of breathing, and 3.3% complained of change of voice character. In the study period which was 6 months, a total of 60 consecutive patients were scored using this scale. 76.7% were female and the mean age was 45.1±15.0 y. Of the 60 patients, 18.3% were smokers at the time of operation. 11.7% patients experienced compressive symptoms and 1.7%had previous radioactive iodine ablation. A score of one would give the minimum total TDS score of 4; a score of five in each category would give the maximum total Thyroidectomy Difficulty Scale (TDS) score of 20. The average total TDS score for all 60 patients was 9. The mean score for vascularity was 2.4, friability was 1.9, mobility was 2.1, and size was 2.5 **(Table1)**.

Table (1): Patient demography and clinical presentation

Age distribution	Range	Mean ± SD	
	25-70	45.1 ± 15	
Sex distribution	No.	Percentage	
Male	14	23.3%	
female	46	76.7%	
clinical presentation	No.	Percentage	
Neck swelling	47	78.3%	
Toxic manifestation	6	10%	
Difficulty of breathing	5	8.3%	
Change of voice character	2	3.3%	
Variables	NDT (41)	DT (19)	P value
cancer	9	2	>0.05
Female	33	13	>0.05
Hashimotos	11	2	<0.05
History ofradiation	1	0	>0.05
Hyperthyroid	10	12	<0.05

In the hyperthyroid patients, the difficult group had more than three times as many patients with ophthalmopathy compared with the non-difficult group (P value<0.05}. In addition, the hyperthyroid group had 63.6% who were treated with lugols potassium iodide drops compared with the hyperthyroid non difficult group (P value <0.05). There were four times as many patients with antithyroglobulin antibodies present in the hyperthyroid difficult group than the hyperthyroid non difficult group (P value = 0.05). Among the Hashimotos thyroiditis and multinodular goiter subsets, there were no statistically significant differences between the two groups. In the cancer cohort, those who had a difficult thyroidectomy had a higher mean preoperative thyroglobulin value compared with non-difficult thyroidectomy patients (920±73 ng/mL versus 55±20 ng/mL), and P value < 0.05 (Table 2).

Of the 60 patients, 20% experience a postoperative complication. Patients with difficulty experienced nearly three times the complication rate compared with the NDT group (36.8% versus 12.2%, P value < 0.05). 3.3% patients experienced transient hoarseness (voice changes) and of those, 1.7% were DT patients compared with 1.7%) in the NDT group (P value > 0.05). No patients in either group suffered permanent hoarseness or permanent hypoparathyroidism. A total of 1.7% patients experienced a postoperative hematoma and all were DT Variables were as follows: age, sex, cancer, hyperthyroidism, Hashimotos, smoker, thyrotropin <0.1 mIU/L, free T4 >1.5 ng/dL, thyroid stimulating immunoglobulin, antithyroglobulin antibody, thyroglobulin >150 ng/mL, ophthalmopathy, three variables were noted to be significant between the difficult thyroidectomy (DT) and non-difficult thyroidectomy (NDT) groups. Hyperthyroidism, the presence of antithyroglobulin antibody >4 IU/mL, and high thyroglobulin (>150 ng/mL) were associated with DT (Table 2).

Table (2): Comparison between difficult and non-difficult group as regard special parameters, and Postoperative complications

Variables	NDT	DT	P value
N	41	19	
Hyperthyroidism			
N	10	12	
Age	45.8±17.8	43±13.2	>0.05
Female	8	9	>0.05
Ophthalmopathy	1	3	<0.05
Lugols	5	9	<0.05
a-TG antibody	1	4	0.05
Cancer			
N	9	2	
Age	49.2 ± 13	45.3 ± 21	>0.05
female	5	1	>0.05
Thyroglobulin	55±20	920± 73 (ng/ml)	<0.05
Postoperative Complications	5 (12.2)	7 (36.8)	<0.05
Transient hoarse	2 (4.9)	2 (10.5)	>0.05
Transient hypo parathyroid	3 (7.3)	4 (21.1)	>0.05
Hematoma	0	1(5.3)	>0.05

DISCUSSION

In this study, we identified some preoperative predictors of surgical difficulty of thyroidectomy and consequently of higher risk of complications. In our opinion, the predictive factors represented those characteristics of the patient or of the thyroid disease that can influence the difficulty of the surgery. The choice of these parameters was made in accordance with our surgical experience and the existing scores.

In this study, we identified some variables that may be associated with increased difficulty of thyroid operations; long operative times and consequently had higher risk of complications. We used thyroidectomy difficulty scale to incorporate all aspect aspects of difficulty intraoperative which were (vascularity, friability, fibrosis or mobility of the gland and gland size) creating a single composite score of difficulty *(Balentine and Sippel, 2016).*

Hyperthyroidism (TSH <0.4 mIU/L) led to increased vascularity and friability of the thyroid gland. They led to long operative times and increased difficulty of the operation. According to this study, hyperthyroid patients with grave's ophthalmopathy, positive antithyroglobulin antibodies, or those treated with lugol's iodine who are undergoing thyroidectomy may have difficult operation and also high risk of complications when compared with hyperthyroid patients without these factors *(Schneider et al., 2014).*

Hallgrimsson et al. (2012) found grave's disease to be associated with increased morbidity specially hypocalcaemia after total thyroidectomy.

Campbell et al. (2013) investigated risk factors for hematoma after thyroidectomy and found Graves' disease to be independently associated with hematoma post thyroidectomy.

Although the complications from thyroid surgery are rarely fatal, their consequences can be life-long. Recurrent laryngeal nerve injury and hypoparathyroidism have the potential to be life-long, costly issues for a patient *(Christou and Mathonnet, 2013)*.

In addition, the preoperative antithyroglobulin antibody levels can be used to predict a potentially more difficult operation in all patients. Hashimoto's thyroiditis (anti-thyroid peroxidase antibody is >30 IU/ml), and pre-operative antithyroglobulin antibody positivity (greater than 4 IU/ml) were associated with a mor difficult thyroidectomy. Anti-thyroid peroxidase antibodies are present in the serum of 90% to 95% of Hashimoto's thyroiditis patients, approximately 80% of grave's disease patients and 10% to 15% of patients with non-autoimmune thyroid disease. Anti-thyroglobulin antibodies were present in 70% to 80% of patients with Hashimoto's thyroiditis, 30% to 40% of patients with grave's disease and 10% to 15% of patients with non-thyroid autoimmune diseases *(Carvalho et al., 2013)*.

High thyroglobulin levels in any case were associated with difficult operation. The patient with cancer who had difficult operation had a higher mean preoperative thyroglobulin value compared with nondifficult patients *(Schneider et al., 2014)*.

Since hyperthyroidism, positive anti-thyroglobulin antibody and positive anti-thyroid peroxidase antibody are associated with difficult thyroidectomy; this information should be included during a patient's preoperative counseling, thereby enabling the discussion to be tailored to the individual patient. These variables helped to identify patients with a great probability of difficult thyroidectomy, placing them at increased risk for postoperative complications. Difficult thyroidectomy was found to have a serious association with postoperative hypocalcaemia. Duration of surgery was found to have a significant association with the difficulty of thyroidectomy. More difficult thyroidectomies were associated with longer operative times. Thus, it helps to predict operative times. This is especially important as more thyroid surgeons perform thyroidectomy on an outpatient basis *(Balentine and Sippel, 2016)*.

Finally, this study was limited as it was a retrospective study from a single place and cannot be generalized for all patients. Further studies with a large cohort of patients are needed to validate these results and to develop a universally accepted score for preoperative prediction of difficult thyroid surgery.

CONCLUSION

Thyroidectomy difficulty scale was used for prediction of factors that may lead to difficult thyroidectomy. Patients with hyperthyroidism, level of thyroglobulin was >150 ng/ mL, and positive antithyroglobulin antibodies, may have a difficult thyroidectomy so may have long operative times with increased risk of complications.

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العوامل التنبؤية لصعوبة إستئصال الغدة الدرقية

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خلفية البحث: جراحة الغدة الدرقية هي واحدة من التدخلات الأكثر شيوعا في جراحة الغدد الصماء. تم تطوير مقياس صعوبة استئصال الغدة الدرقية لتحديد العمليات الأكثر صعوبة، والتي يوازيها زيادة وقت العملية، ومشاكل أثناء العملية، ومعدلات مضاعفات عالية.

الهدف من البحث: تحديد المقاييس السريرية والكيميائية الحيوية والمرضية التي يمكن أن تنبئ بصعوبة إستئصال الغدة الدرقية قبل الجراحة.

المرضى وطرق البحث: هذه الدراسة المستقبلية تم إختيار المرضى فيها بطريقة عشوائية وهي دراسة قسمية عرضية مطلقة وغير تداخلية. وقد أجريت على ستين مريضا. وقد تم تشخيص هؤلاء المرضى بالفعل على أنهم يعانون من مرض بالغدة الدرقية ويحتاجون إلى إستئصالها. وقد تم إستخدام أربعة عناصر لتسجيل درجة صعوبة عمليات الغدة الدرقية، كما تم تسجيل العوامل المتعلقة بالمريض والمرض لكل مريض، وتمت مقارنة المجموعة الصعبة و المجموعة غير الصعبة.

نتائج البحث: تم تسجيل ما مجموعه ٦٠ مريضا باستخدام هذا المقياس. منهم ٤٦يعانون من فرط نشاط الغدة الدرقية، و ١٣ من

هاشيموتو، و ١١ من سرطان الغدة الدرقية. وكان المرضى الذين يعانون من فرط نشاط الغدة الدرقية، و الذين مستوى الأجسام المضادة لمضادات الغدة الدرقية لديهم > ٤ وحدة دولية/مل، والذين لديهم مستوى الثيروجلوبين > ١٥٠نانو غرام/مل قد يرتبطون بصعوبة إستئصال الغدة الدرقية.

الإستنتاج: المرضى الذين تم تشخيصهم على أنهم يعانون من فرط نشاط الغدة الدرقية، وزيادة الثيروجلوبين في الدم، والأجسام المضادة لمضادات الغدة الدرقية قبل الجراحة يرتبطون بصعوبة إستئصال الغدة الدرقية. وهذا المقياس يمكن أن يساعد الجراحين في التنبؤ بالعمليات الصعبة والإستعداد لها.