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RISK FACTORS ASSOCIATED WITH DIFFICULT THYROID SURGERY

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ABSTRACT

Background: Thyroid surgery is one of the commonest interventions in endocrine surgery. Thyroidectomy Difficulty Scale (TDS) created by Schneider was used to identify difficult operations, which correlate with long operative times, intraoperative difficulties, and more complication rates. **Aim of Study:** To determine clinical, biochemical, and pathological elements that can anticipate the difficulty in thyroid surgery preoperatively. **Patients and methods:** This study was a prospective review of thyroidectomies performed at Otolaryngology Department, Al-Jamhory Teaching Hospital in Mosul, Iraq, from January 2022 to May 2024. It includes 77 patients, those who were already diagnosed as thyroid disease needing total or near total thyroidectomy. **Results:** Older age patients were significantly related to difficult thyroidectomy (p=0.05). The current study found that toxic nodular goiter and thyroid carcinoma operations were significantly associated with difficult thyroidectomy (p=0.002), also found a significant association between hyperthyroidism and difficult thyroidectomy (p=0.003). **Conclusions:** Risk factors for difficult thyroidectomy are older age, toxic nodular goiter, thyroid carcinoma, hyperthyroidism, and short neck of patients. **Aim of study:** To establish clinical, biochemical, and pathological elements that can anticipate the difficulty in thyroid surgery preoperatively.

KEYWORDS: Thyroidectomy, TDS, hyperthyroidism.

INTRODUCTION

Thyroid surgery is one of the commonest endocrine surgeries in the world. On last decades, Thyroidectomy developed from risky and bloody operation to a safe surgery with good results, but few major risks.[1,2]

Generally, difficult thyroidectomy is associated with hyperthyroidism and thyroiditis. It is difficult to predict the degree of difficulty in each surgery. Whenever it is possible to predict a difficult thyroidectomy before operation, the surgeon will get ready, and the patient can be notified about higher probability of complications.[3] Difficulty thyroidectomies are determined by several factors which is alone or in presence of others make operation more challenging and increase the risk of complications.[4]

Surgery is one of options of treatment in Graves' disease and hyperthyroidism.[5] Thyroidectomy is also a viable choice for patients with symptomatic thyroid masses. Patients who have compressive symptoms like dysphagia, dyspnea, and/or hoarseness due to a large goiter should undergo a thyroidectomy.[6] Choosing the type of surgery in thyroid cancers depends on disease extent (tumor size, lymph nodes metastasis and extra thyroid extension), patient age and past medical history.[7] Hashimoto's thyroiditis is an example of autoimmune disease treated conservatively. However, in some patients, the surgery is obligatory. These include compression symptoms, solitary toxic nodule, suspicious of malignancy and cosmetic reason due to large goiter.[8]

The gravest complications associated with thyroid surgery are recurrent laryngeal nerve and parathyroid glands' injuries. The incidence of these injuries increases with difficulty of thyroidectomy.[9]

Hypocalcemia/hypoparathyroidism is one of common complications of thyroidectomy.[10]

After surgery, hematoma is a rare but dangerous complication. To prevent hematoma formation, it is important to stop anticoagulant medications before thyroidectomy and hemostasis should be carefully

maintained during surgery. The rates of infection after thyroidectomy have significantly decreased with improvements in technology and aseptic technique.[11]

Many factors related to the patient, thyroid gland and surgeon can affect the degree of difficulty of this surgery, Schneider, and his colleagues (2014) develop Thyroidectomy Difficulty Scale" (TDS) as objective measurement of difficult thyroidectomy, which are four components (Friability, Vascularity, Mobility / Fibrosis and gland size), 20-point scale, each component was score on a five-point scale. After operation the surgeon complete TDS sheet.[9]

Many surgeons documented marked some thyroid disease as highly difficult in resection and associated with complication rates like toxic nodular goiter, Graves' disease, Hashimoto's thyroiditis, and thyroid carcinoma.[12-13]

The aim of study

To establish clinical, biochemical, and pathological elements that can anticipate the difficulty in thyroid surgery preoperatively (longer surgical time and high possibility of complications).

PATIENTS AND METHODS

This study was a prospective review of thyroidectomies performed at Otolaryngology Department, Al-Jamhory Teaching Hospital in Mosul, Iraq., from January 2022 to May 2024. It includes 77 patients, those who were already diagnosed with thyroid disease which needs total or near total thyroidectomy Inclusion criteria; Patient needs total or near total thyroidectomy, first surgery on thyroid gland.

Exclusion criteria**;** Patient undergoing concomitant neck dissection, patient undergoing re-operation thyroidectomy. Patients' assessment, all patient's data collected in questionnaire form: Demographic characteristics of participants: Age, gender, height, weight, and BMI., history taking and clinical examination: general look and local examination. Laboratory investigations: TFT, serum calcium before surgery, FNAC, CBC and Blood group & Rh. Imaging techniques: neck US and chest X-ray. intraoperative finding and complications , postoperative complications.

Thyroidectomy difficulty scale was filled: 4 items: 1. Vascularity; 2. Friability; 3. Mobility / Fibrosis; and 4. Gland size. Each item is scored on a scale of 1-5.
Vascularity: from 1 — normal to 5 — extensive. Friability: from 1 — Easy to retract to 5 — Unable to hold with any clamp. Mobility/Fibrosis: from 1— elevate easily to 5 — Fixed in position / unable to retract. Gland size: from 1 — Normal size (maximum Dimension up to 6 cm) to 5 — Large goiter (maximum dimension; 12 cm) (Figure 1).

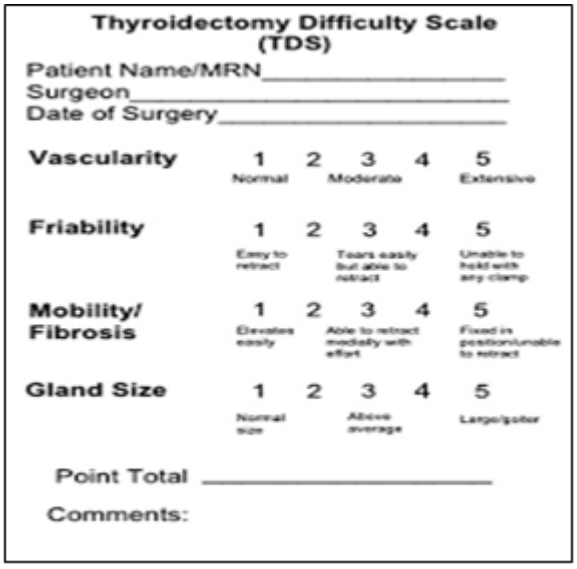

Figure 1: Thyroidectomy Difficulty Scale (TDS) sheet.

The patients were divided based on thyroid disease to hyperthyroidism, Hashimoto's thyroiditis, thyroid nodule, thyroid cancer or multi nodular goiter (MNG). The relation between the difficulty of thyroidectomy and incidence of complications was studied, the relation between the difficulty and duration of operation was also studied. The correlation between Thyroidectomy Difficulty Scale scores and preoperative and postoperative parameters was identified.

RESULTS

Mean vascularity score of thyroidectomy patients was (2.5), mean friability score was (2.3), mean mobility/fibrosis score was (2.2), mean gland size score was (2.7) and mean total TDS score was (9.8); 49.4% of patients had non-difficult thyroidectomy and 50.6% of patients had difficult thyroidectomy. (Table 1)

Table 1: Thyroidectomy difficulty scale (TDS).

Variable	No.	%
Vascularity score mean±SD (2.5±1)		
Friability score mean±SD (2.3±0.8)		
Mobility/Fibrosis score mean±SD (2.2±0.9)		
Gland size score mean±SD (2.7±0.8)		
Total TDS score mean±SD (9.8±2.8)		
NDT	38	49.4
DT	39	50.6
Total	77	100.0

This study included 77 patients' undergone total or near total thyroidectomy. The mean age of patients were 47.8±15.4 years and range of (8-85 years); 26% of them were in age group 40-49 years and 23.4% of patients were in age of 60 years and above. Female were more than male patients with ratio of 2.5:1. Mean BMI of thyroidectomy patients was 29.3±4.8 Kg/m^2; 37.7% of them were obese.

No significant differences were observed between patients with non- difficult thyroidectomy and patients with difficult thyroidectomy regarding age groups (p=0.08), however, mean age of patients with difficult thyroidectomy was significantly higher than mean age of patients with non- difficult thyroidectomy. No significant differences were observed between patients with non-difficult thyroidectomy and patients with difficult thyroidectomy regarding gender (p=0.6) and BMI (p=0.1). (Table 2 and Figure 2)

Table 2: Distribution of general characteristics according to thyroidectomy difficulty scale.

Variable	TDS				P
	NDT		DT		
	No.	%	No.	%	
Age					0.08* NS
<20 years	0	-	2	5.1	
20-29 years	5	13.2	2	5.1	
30-39 years	9	23.7	4	10.3	
40-49 years	12	31.6	8	20.5	
50-59 years	5	13.2	12	30.8	
≥60 years	7	18.4	11	28.2	
Mean±SD (years)	44.4±13.5		51.1±16.5		**0.05**** S
Gender					0.6*** NS
Male	10	26.3	12	30.8	
Female	28	73.7	27	69.2	
Body mass index					0.1* NS
Underweight	0	-	1	2.6	
Normal	2	5.3	8	20.5	
Overweight	22	57.9	15	38.5	
Obese	14	36.8	15	38.5	
Mean±SD (Kg/m^2)	29.2±3.3		29.3±5.9		0.9** NS

* Fishers exact test, **Independent sample t-test, ***Chi square test, NS=Not significant, S=Significant.

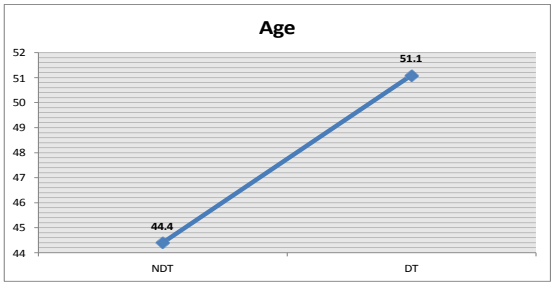

Figure 2: Mean of age distribution according to TDS.

The main indications of thyroidectomy were multi-nodular goiter (57.1%), thyroid nodule (24.7%) and toxic nodular goiter (11.7%), etc. Toxic nodular goiter and thyroid carcinoma indications were significantly associated with difficult thyroidectomy (p=0.002). (Table 3)

Table 3: Distribution of thyroidectomy characteristics according to thyroidectomy difficulty scale.

Variable	TDS				P
	NDT		DT		
	No.	%	No.	%	
Indication of operation					**0.002***S
thyroid carcinoma	0	-	3	7.7	
Multi-nodular goiter	21	55.3	23	59.0	
Hashimoto's thyroiditis	0	-	1	2.6	
solitary nodule	16	42.1	3	7.7	
Toxic nodular goiter	1	2.6	8	20.5	
Graves' disease	0	-	1	2.6	

* Fishers exact test, S=Significant.

Preoperatively, 71.4% of patients were euthyroid, 24.7% of them were hyperthyroidism and 3.9% of them were hypothyroidism. There was a significant association between hyperthyroidism status of patients and difficult thyroidectomy (p=0.003). (Table 4 and Figure 3)

Table 4: Distribution of thyroid status according to thyroidectomy difficulty scale.

Variable	TDS				P
	NDT		DT		
	No.	%	No.	%	
Thyroid status					**0.003***S
Euthyroid	33	86.8	22	56.4	
Hyperthyroidism	3	7.9	16	41.0	
Hypothyroidism	2	5.3	1	2.6	

* Chi-square test, NS=Not significant, S=Significant.

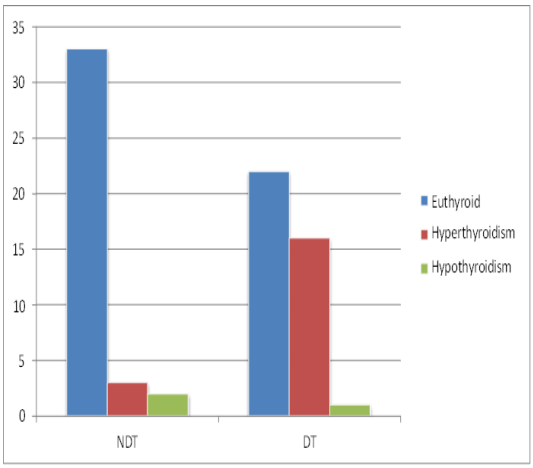

Figure 3: Distribution of thyroid status according to TDS.

Short neck of patients was detected in 22.1% of them. Mean surgery time was (74.4 minutes), 41.6% of thyroidectomy operations were done in 60 minutes and less, while 58.4% of them were done in more than 60 minutes. The intraoperative complications were absent in 58.4% of patients, the intraoperative complications were bleeding (11.7%), adhesions (9.1%), adhesions and bleeding (7.8%), vessel injury (3.9%), etc. Retrosternal extension was found in 10.4% of patients, insertion of drain was observed for 61% of patients. Retrosternal extension (p=0.9) and insertion of drain (p=0.5). There was a significant association between short neck of patients and difficult thyroidectomy (p=0.01). Mean thyroidectomy operation time was significantly longer among patients with difficult thyroidectomy (p=0.02). There was a significant association between intraoperative complications like adhesions and bleeding and difficult thyroidectomy (p=0.002). (Table 5)

Table 5: Distribution of operative characteristics according to thyroidectomy difficulty scale.

Variable	TDS				P
	NDT		DT		
	No.	%	No.	%	
Neck					**0.01***S
Short	4	10.5	13	33.3	
Adequate	34	89.5	26	66.7	
Operation time					**0.05***S
≤60 minutes	20	52.6	12	30.8	
>60 minutes	18	47.4	27	69.2	
Mean±SD (minutes)	76.7±23.2		81±26.4		**0.02****S
Intraoperative complications					**0.002*****S
No	31	81.6	14	35.9	
Vessel injury	1	2.6	2	5.1	
Adhesions	0	-	7	17.9	
Bleeding	5	13.2	4	10.3	
Adhesions and bleeding	0	-	6	15.4	
Vessel injury and adhesions	0	-	1	2.6	
Vessels injury and bleeding	0	-	2	5.1	
Vessel injury, adhesions and bleeding	0	-	2	5.1	
Adhesions and muscle invasion	1	2.6	1	2.6	
Retrosternal extension					0.9*** NS
Yes	4	10.5	4	10.3	
No	34	89.5	35	89.7	
Insertion of drain					0.5* NS
Yes	22	57.9	25	64.1	
No	16	42.1	14	35.9	

* Chi square test, **Independent sample t-test,
*** Fishers exact test, NS=Not significant, S=Significant.

Neck pain was shown postoperatively in 9.1% of patients and no patients had hematoma, while 10.4% of patients had signs of hypocalcemia postoperatively and four patients had sign of RLN injury postoperatively; one patient had hoarseness and three patients had stridor. No significant differences were observed between patients with non-difficult thyroidectomy and patients with difficult thyroidectomy regarding neck pain postoperatively (p=0.7), signs of hypocalcemia postoperatively (p=0.9). There was significant association between sign of RLN injury postoperatively and difficult thyroidectomy (p=0.04). (Table 6)

Table 6: Distribution of postoperative outcomes according to thyroidectomy difficulty scale.

Variable	TDS				P
	NDT		DT		
	No.	%	No.	%	
Neck pain postoperatively					0.2* NS
Yes	2	5.3	5	12.8	
No	36	94.7	34	87.2	
Sign of hypocalcaemia postoperatively					0.9* NS
Yes	4	10.5	4	10.3	
No	34	89.5	35	89.7	
Sign of RLN injury postoperatively					**0.04*** S
Yes	0	-	4	10.3	
No	38	100.0	35	89.7	
If yes					-
Hoarseness	0	-	1	33.3	
Stridor	0	-	3	66.7	

*Fishers exact test, NS=Not significant, S=Significant.

DISCUSSION

Thyroidectomy is a well-established surgical procedure performed to remove all or part of the thyroid gland. It is commonly indicated in the management of thyroid cancer, benign nodules, and thyroid disorders that are unresponsive to medical treatment. The difficulty of thyroidectomy arises from the complex anatomy of the neck, the presence of delicate neighboring structures, and the limited operative space, in addition to patient-related factors.[7]

Present study showed that mean vascularity score of thyroidectomy patients was (2.5), mean friability score was (2.3), mean mobility/fibrosis score was (2.2), mean gland size score was (2.7) and mean total TDS score was (9.8); 50.6% of patients had difficult thyroidectomy according to TDS. These findings are higher results of Farag study[14] in Egypt on 378 patients undergone thyroidectomy which found that mean total score of TDS was (8.9) and 31.7% of patients had difficult thyroidectomy. This higher prevalence of difficult thyroidectomy might be attributed to fact that our center receiving complicated thyroid cases from other hospitals in Mosul. Many authors stated that it is difficult to find different preoperative scores, or scales used for prediction of difficulty of surgical operation according to risk factors related to patients or to the surgery.[15-16] In current study, older age patients were significantly related to difficult thyroidectomy (p=0.05). This finding is consistent with results of Inversini et al[17] study in Italy which reported that increased age of patients is a risk factor for difficult thyroidectomy but not in absolute term and related to co-morbidities. The more post-thyroidectomy complications among elderly age population are not related to chronological age, but to biological age.[17] In their review study, Ng et al[18] documented those clinical co-morbidities of elderly age population are the main cause of difficulty for thyroidectomy and they need good preoperative care than younger age population.

The present study found that toxic nodular goiter and thyroid carcinoma operations were significantly associated with difficult thyroidectomy (p=0.002). These findings agree with results of Cirocchi et al[19] study in Italy and Kwak et al[20] study in China which reported higher difficulty of thyroidectomy for patients with toxic nodular goiter and thyroid carcinoma. The difficulty of thyroidectomy for those patients might be related to longer surgical operation time and delicate pathology of these diseases.[20] Our study also found a significant association between hyperthyroidism status of patients and difficult thyroidectomy (p=0.003). This finding coincides with results of Mok et al[3] study in USA which revealed that hyperthyroidism, high preoperative level of serum thyroglobulin and anti-thyroglobulin antibodies are the predicting factors of difficult thyroidectomy. In Egypt, a prospective study carried out by Radwan et al[21] reported that main predictors of difficult thyroidectomy were hyperthyroidism, higher levels of serum

thyroglobulin and antithyroglobulin antibodies. Current study showed a significant association between short neck of patients and difficult thyroidectomy (p=0.01). This finding is like Bothra et al.[22] study in India which reported that short neck of patients is considered as preoperative predictor of difficulty of thyroidectomy. The short neck is related to obesity and lead to decreasing the space for surgeons working.[22] Despite our findings, many literatures revealed a direct link between incidence of perioperative complications and risk factors like thyroid disorders, specific characteristics of each patient or the thyroid gland, surgeon's experience and surgical technique, even with the use of optical magnification tools[23-25]

The present study also found that mean thyroidectomy operation time was significantly longer among patients with difficult thyroidectomy (p=0.02). This finding is consistent with results of D'Orazi et al[27] study in Italy which revealed that only the operative time was significantly associated with difficulty scale of thyroidectomy. In USA, a prospective study conducted by Schneider et al[9] found by multiple regression analysis that thyroidectomy difficulty scale scores were independently predicted the operative time. The current study found a significant association between intraoperative complications like adhesions and bleeding with difficult thyroidectomy (p=0.002). These findings are similar to results of Radwan et al[21] study in Egypt which reported higher intra-operative complication rates in patients with difficult thyroidectomy. Our study revealed a significant association between sign of recurrent laryngeal nerve injury postoperatively and difficult thyroidectomy (p=0.04). This finding is consistent with results of many literatures such as Zakaria et al[28] study in Australia and Schneider et al.[9] study in USA which stated that the thyroidectomy difficulty scales is related directly with postoperative complications of thyroidectomy.

CONCLUSIONS

- The prevalence of difficult thyroidectomy in Al-Jamhory Teaching Hospital in Mosul city is high.
- Risk factors for difficult thyroidectomy are older age, diagnosis of toxic nodular goiter and thyroid carcinoma, hyperthyroidism and short neck of patients.
- The difficult thyroidectomy is directly linked to longer operation time, intra-operative complications, and sign of recurrent laryngeal nerve injury.

RECOMMENDATIONS

- Encouraging surgeons to adopt the thyroidectomy difficulty scales in planning for thyroidectomy surgery to decrease complications.
- Predictors for difficult thyroidectomy like older age and hyperthyroidism should be taken in consideration during preparation for thyroidectomy.
- Multi-centers large studies on thyroidectomy difficulty scales and predictors of difficulty must be supported.

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