


Original Research Article

Factors predicting difficulty of thyroidectomy preoperatively

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Abstract

Background: Today, thyroidectomy is a common operation used to treat various thyroid disorders. Nowadays, many high-volume thyroid surgeons are discharging patients on the same day of thyroidectomy. The incidence of complications following thyroidectomy is directly linked to the difficulty of the procedure. So, if we can predict the difficulty of thyroidectomy preoperatively, we can anticipate complications and decide on which patients will require in-patient care.

Materials and methods: A thyroidectomy difficulty scale was developed by Schneider and colleagues. This scale was used in our study to classify patients in to difficult thyroidectomy group and non-difficult thyroidectomy group. The association between preoperative variables and difficulty of thyroidectomy was studied.

Results: Statistical analysis revealed that there was a significant association between hyperthyroidism and difficult thyroidectomy. Similarly, there was a significant association between positive anti-thyroid peroxidase antibody (which defines Hashimoto's thyroiditis) and difficult thyroidectomy. Also, there was a significant association between positive anti-thyroglobulin antibody and difficult thyroidectomy. Difficult thyroidectomy was found to have a significant association with postoperative hypocalcemia. Statistical analysis also showed duration of surgery to have a significant association with difficulty of thyroidectomy

Conclusion: Patients with hyperthyroidism, positive anti-thyroid peroxidase antibodies, and positive anti-thyroglobulin antibodies have a high probability of a difficult thyroidectomy, associated with longer operative times and increased complications. This information can improve preoperative risk counseling and lead to more efficient scheduling of the operating room.

Key words

Thyroidectomy, Preoperatively, Factors, Difficulty.

Introduction

Thyroidectomy is one of the commonest surgeries performed worldwide. The degree of 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 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 [1, 2]. In present study, a modification of the above scale was used for convenience. The 4 items (vascularity, friability, mobility/fibrosis, gland size) were scored on a 3-point scale, with 12 points being the maximum possible score. The main complications associated with thyroidectomy are 1) Injury to laryngeal nerves and; 2) Injury to parathyroids. As the thyroidectomy becomes more difficult, the incidence of these complications increases. Traditionally, conditions associated with difficult thyroidectomy include hyperthyroidism and thyroiditis. But 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 prepared. The purpose of this study was to identify preoperative variables predicting a difficult thyroidectomy.

Objectives

- To identify clinical, biochemical and pathological parameters that can predict difficulty in thyroidectomy preoperatively.
- Counsel patients regarding operative risk.
- Improve operating room scheduling (cases in which difficulty is anticipated taken up earlier on the day).

Materials and methods

Inclusion criteria

- First surgery on thyroid gland
- Total/Near total / Subtotal thyroidectomy

Exclusion criteria

- Undergoing re-operation thyroidectomy
- Undergoing concomitant neck dissection

Sample size: 74 Patients

Duration: Jun 2016 to August 2018

After taking consent from patients who were willing to participate in the study, history was taken and physical examination was carried out. The investigations including Thyroid function test, FNAC, X-ray neck, ultrasound neck, serum anti-thyroid peroxidase antibody, serum anti-thyroglobulin antibody, serum thyroglobulin was noted. Immediately after surgery, the surgeons completed the 12-point Thyroidectomy Difficulty Scale. Thyroidectomy difficulty scale used in this study is a 4 item (vascularity, friability, mobility/fibrosis, gland size), 12-point scale, in which each item is scored on a 3-point scale. A total score of 6 or more is considered as Difficult Thyroidectomy. A total score less than 6 is considered as non-difficult thyroidectomy.

Time taken for surgery and postoperative complications including hypocalcemia, hoarseness of voice and hematoma neck were recorded. Thyroidectomy difficulty scale: 4 items: 1. Vascularity; 2. Friability; 3. Mobility / Fibrosis; and 4. Gland size. Each item is scored on a scale of 1-3. Vascularity: 1 – Normal; 2 – Moderate; 3 – Extensive. Friability: 1 – Easy to retract; 2 - Tears easily, but able to retract; 3 – Unable to hold with any clamp. Mobility/Fibrosis: 1 – Elevates easily; 2 – Able to retract medially with effort; 3 – Fixed in position / unable to retract.

Gland size: 1 – Normal size (maximum dimension up to 6cm); 2 – Above average (maximum dimension >6cm up to 12cm); 3 – Large goiter (maximum dimension > 12cm). Threshold TDS – 6; <6 - Non-difficult thyroidectomy; ≥6 - Difficulty thyroidectomy.

The patient population was classified based on a diagnosis of hyperthyroidism, Hashimoto's thyroiditis, thyroid cancer or MNG. Hyperthyroidism is defined as a patient having TSH <0.4 mIU/L. A patient was defined as having Hashimoto's thyroiditis if anti-thyroid peroxidase antibody is >30 IU/ml. A thyroglobulin level >150 ng/ml was considered "high" thyroglobulin. Anti-thyroglobulin antibody greater than 4 IU/ml were considered positive for anti-thyroglobulin antibody.

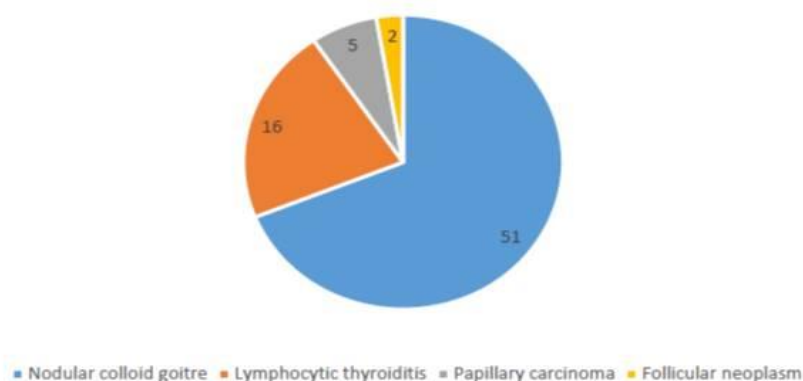
Hoarseness was defined as voice change following surgery and hypocalcemia was defined as serum calcium <8 mg/dl. Both are defined as transient if they resolve within 6 months and permanent if they persist over 6 months. The aim was to determine if preoperative variables like age, sex, hyperthyroidism, thyroid cancer, positive serum anti-thyroid peroxidase antibody, positive serum anti-thyroglobulin antibody, elevated serum thyroglobulin correlated with the difficulty of thyroidectomy. Also, the relation

between the difficulty of thyroidectomy and incidence of postoperative complications was examined. The relation between the difficulty of thyroidectomy and duration of surgery was also studied. The correlation between Thyroidectomy Difficulty Scale scores and preoperative and postoperative variables was found out. The data was entered into MS excel sheet and was analyzed using SPSS software using chi-square test. A p value of <0.05 was determined to be significant.

Results

A total of 74 patients were studied. This included 71 female patients and 3 male patients. Following thyroidectomy, patients were scored using Thyroidectomy Difficulty Scale (TDS). Of this, 51 (68.9%) had nodular colloid goiter, 16 (21.6%) suffered from Hashimoto's thyroiditis, 5 (6.8%) had papillary carcinoma thyroid and 2 (2.7%) had follicular neoplasm (**Figure - 1**).

Figure - 1: FNAC.



Difficult thyroidectomy

Thyroidectomy Difficulty Scale (TDS) consists of 4 parameters –vascularity, friability, mobility/fibrosis, and gland size. Each was given a score ranging from 1 to 3. The minimum score would be 4 and the maximum score possible would be 12. A score of 6 or more was considered as difficult Thyroidectomy. Those with scores less than 6 were taken as having a non-difficult thyroidectomy. In this study, 25

patients had difficult thyroidectomy and 49 had non-difficult thyroidectomy (**Figure - 2**).

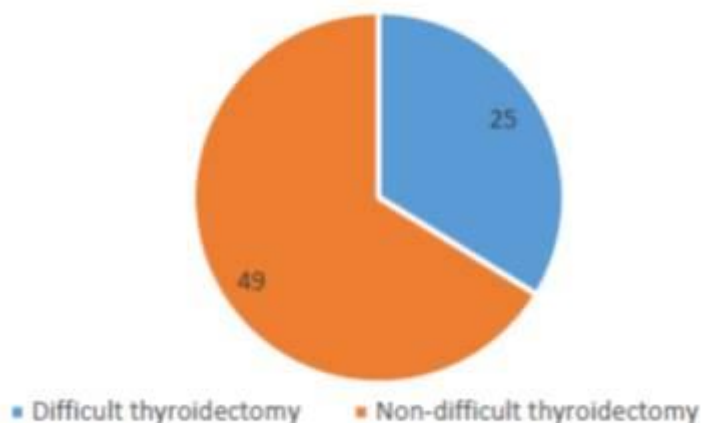
Operative times

The average operative time for all the cases was 95.7 minutes. The average operative time for difficult thyroidectomy cases was 115.8 minutes. This indicates that difficult thyroidectomy patients' operation took more time than overall average operative time. The average operative

time for non-difficult thyroidectomy cases was 90.9 minutes and this indicates that non-difficult thyroidectomy patients' operation took less time than overall average operative time. On chi-

square analysis, operative time was found to have a significant association ($p = 0.000$) with difficulty of thyroidectomy.

Figure - 2: Difficulty of thyroidectomy.



Complications

Of the 74 patients, 29(39.2%) experienced complications. 27 patients had hypocalcemia. 1 patient had both hypocalcemia and voice change and one patient had voice change alone. Patients with difficult thyroidectomy experienced nearly three times the complication rate compared to non-difficult thyroidectomy group (72% vs 22.4%).

Of the 28 patients with transient hypocalcemia, 17 (60.7%) were difficult thyroidectomy patients compared to 11 in the non-difficult thyroidectomy group. 2 patients had transient voice change and both belonged to the difficult thyroidectomy group. No patients of either group suffered permanent hypoparathyroidism or permanent hoarseness of voice. No patient developed postoperative hematoma.

Statistical analysis

Statistical analysis using chi-square test revealed that there was a significant association between hyperthyroidism and difficult thyroidectomy ($P=0.018$). Similarly, there was a significant association between positive anti-thyroid peroxidase antibody (which defines Hashimoto's thyroiditis) and difficult thyroidectomy

($P=0.003$). Also, there was a significant association between anti-thyroglobulin antibody and difficult thyroidectomy ($p= 0.019$). Difficult thyroidectomy was found to have a significant association with postoperative hypocalcemia ($P= 0.000$).

On chi-square analysis, duration of surgery was found to have a significant association ($p=0.000$) with difficulty of thyroidectomy. Variables like age, sex, surgery done (total/ near-total/ sub-total thyroidectomy), tracheal compression/deviation, elevated serum thyroglobulin were not found to have a significant association with the difficulty of thyroidectomy.

Discussion

During the late 19th and early 20th century, thyroidectomy was associated with a 50% mortality and equally high morbidity. This led many medical experts to consider thyroid surgery barbaric. Samuel Gross referred to thyroidectomy as "horrid butchery," and it was banned by the French medical society due to its high mortality [3]. Today, thyroidectomy is associated with virtually zero mortality and an extremely low morbidity when performed by

high-volume surgeons [4]. Yet, complications from thyroidectomy can be life-altering. These include injury to the recurrent laryngeal nerves causing hoarseness and dysphagia, injury to the parathyroid glands causing hypocalcemia, in addition to neck hematoma. Fortunately, the risk of permanent complications range from 1–2% in experienced hands [5]. 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 [6, 7].

Traditionally thyroidectomy is performed as an inpatient surgery. This is out of concerns over possible complications including hematoma, hypocalcemia, laryngeal nerve damage and airway compromise. However, in recent years the volume of outpatient thyroidectomy has increased with patients being discharged on the same day or the morning after surgery [8]. Outpatient operating rooms can increase operative time efficiency and therefore increase operating room utilization by good patient selection and more efficient staffing. Safely performing outpatient thyroid surgery requires careful patient selection and preparation. It is important to identify both social and medical factors that place patients at higher risk for complications [8].

If patient variables were known to contribute to a more difficult and potentially higher risk thyroid removal or result in a potentially longer operation, a surgeon would be able to appreciate these factors and take them into consideration when planning a thyroidectomy. This knowledge can improve operating room scheduling (cases in which more difficulty is anticipated scheduled earlier) and preoperative risk counseling. Knowledge of these predictors of difficulty can aid in counseling patients regarding individualized operative risk.

Thyroid surgeons associate certain thyroid disease processes with a more difficult resection and higher complication rates. These include

thyroidectomy for Graves' disease, Hashimoto's thyroiditis, large goitre, or widely invasive thyroid carcinomas [6, 9-12]. For example, transient complications range from 12 – 38% for patients with Hashimoto's thyroiditis and 11–28% for Graves' disease [6, 11, 13]. Permanent complications are also reported to be higher in these subsets.

Complication rates and operative time are surrogates for difficulty. Difficulty scales have been developed for other types of procedures, often as a means to quantify the learning curve [14]. The notion of difficulty in thyroid surgery literature remains subjective and is limited to case reports, opinion, and technique papers [15-18]. Traditionally cited factors contributing to difficulty in thyroid surgery include increased vascularity, inflammation, friability, fibrosis, and large gland size [19-21].

The thyroid surgery literature includes numerous examples of each individual item that comprises the Thyroidectomy Difficulty Scale. For example, Graves' disease leads to increased vascularity and friability of thyroid gland [22]. Fibrosis, another component of the TDS, is seen in Hashimoto's thyroiditis. Larger gland size contributes to higher complication rates, specifically airway complications and transient hypocalcemia [18]. The Thyroidectomy Difficulty Scale, developed by Schneider and colleagues incorporates all of these aspects of difficulty — vascularity, friability, mobility and gland size — to create a single composite score of difficulty [1, 2].

Preoperative variables that predict a difficult thyroid surgery were identified using the Thyroidectomy Difficulty Scale. Hyperthyroidism (TSH <0.4 mIU/L), Hashimoto's thyroiditis (anti-thyroid peroxidase antibody is >30 IU/ml), and pre-operative anti-thyroglobulin antibody positivity (greater than 4 IU/ml) were associated with a more 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 are 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 [23]. These variables will help identify patients with whom there is a greater probability of difficult thyroidectomy, placing them at increased risk for postoperative complications.

Difficult thyroidectomy was found to have a significant association with postoperative hypocalcemia. 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 [5, 24].

Proper informed consent is ethically and legally required for all planned therapies; informed consent for a surgery must include the risks, expected benefits and alternatives to treatment, and must also include discussion of the expected postoperative course, including other interventions that may be needed if complications occur [25, 26]. 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.

Conclusion

This study discovered that hyperthyroid (TSH <0.4 mIU/L) patients had more difficult thyroidectomies. Also, Anti-thyroid peroxidase antibody >30 IU/ml, which is consistent with a diagnosis of Hashimoto's thyroiditis is associated with a more difficult thyroidectomy. In addition to this Anti-thyroglobulin antibody >4 IU /ml is

also associated with a more difficult thyroidectomy. Difficult thyroidectomy was associated with longer operative times and increased complications. This information can improve preoperative risk counseling and lead to more efficient scheduling of the operating room.

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