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Identifying predictors of a difficult thyroidectomy

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ABSTRACT

Background: A Thyroidectomy Difficulty Scale (TDS) was previously developed that identified more difficult operations, which correlated with longer operative times and higher complication rates. The purpose of this study was to identify preoperative variables predictive of a more difficult thyroidectomy using the TDS.

Methods: A four item, 20-point TDS, was used to score the difficulty of thyroid operations. Patient and disease factors were recorded for each patient. Difficult thyroidectomy and non-difficult thyroidectomy (NDT) patients were compared. A final multivariate logistic regression model was constructed with significant ($P < 0.05$) variables from a univariate analysis.

Results: A total of 189 patients were scored using TDS. Of them, 69 (36.5%) suffered from hyperthyroidism, 42 (22.2%) from Hashimotos, 34 (18.0%) from thyroid cancer, and 36 (19.0%) from multinodular goiter. Among hyperthyroid patients, the DT group had a greater number preoperatively treated with Lugols potassium iodide (81.6% DT *versus* 58.1% NDT, $P = 0.032$), presence of ophthalmopathy (31.6% DT *versus* 9.7% NDT, $P = 0.028$), and presence of (>4 IU/mL) antithyroglobulin antibodies (34.2% DT *versus* 12.9% NDT, $P = 0.05$). Using multivariate analysis, hyperthyroidism (odds ratio [OR], 4.35, 95% confidence interval [CI], 1.23–15.36, $P = 0.02$), presence of antithyroglobulin antibody (OR, 3.51, 95% CI, 1.28–9.66, $P = 0.015$), and high (>150 ng/mL) thyroglobulin (OR, 2.61, 95% CI, 1.06–6.42, $P = 0.037$) were independently associated with DT.

Conclusions: Using TDS, we demonstrated that a diagnosis of hyperthyroidism, preoperative elevation of serum thyroglobulin, and antithyroglobulin antibodies are associated with DT. This tool can assist surgeons in counseling patients regarding personalized operative risk and improve OR scheduling.

1. Introduction

Today, thyroidectomy is a common operation used to treat and/or cure various thyroid disorders. Over ninety thousand thyroid procedures were performed during 2006 in the United States, and the number of thyroid operations continues to rise [1,2]. The degree of difficulty and length of a thyroid procedure can be influenced by a variety of factors, many of which cannot be assessed until the patient is in the operating room.

To have a more objective measurement of difficulty, Schneider *et al.* [3] developed a "Thyroidectomy Difficulty Scale" (TDS). TDS is a four item (vascularity, friability, mobility or fibrosis, and gland size), 20-point scale, in which each item is scored on a five-point scale. Immediately after a thyroidectomy, the surgeons completed the TDS. In our previous

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work, this scale was internally validated and was shown to have high inter-rater agreement. Higher TDS scores were noted to correlate with both longer operative times and higher rates of complications [3].

Although the complications from thyroid surgery are rarely fatal, their consequences can be lifelong. The main complications associated with thyroidectomy include injury to the recurrent laryngeal nerve, damage to the parathyroid glands, and postoperative hematoma. Recurrent laryngeal nerve injury and hypoparathyroidism have the potential to be lifelong, costly issues for a patient [4–6]. The incidence of these complications increases with thyroid pathology associated with increased gland size, fibrosis, vascularity, or inflammation [4–6]. Although certain disease states such as hyperthyroidism, goiter, and thyroiditis are associated with more difficult thyroidectomies (DTs), the degree of difficulty often varies widely, and it is difficult to quantify or predict the level of difficulty of these cases preoperatively [3,5–11]. Surgical risk in thyroidectomy is well studied, but there is no literature regarding the quantification of "difficulty" or an objective measure of "difficulty" for a thyroidectomy [4–9,12–15]. Difficulty scales have been developed for nephrectomy [16] and choledochotomy [17], but none exist in the area of thyroid surgery. This novel TDS has allowed for quantification of difficulty for thyroidectomy.

If particular 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 OR scheduling and preoperative risk counseling. The purpose of this study was to identify objective predictors of a more DT.

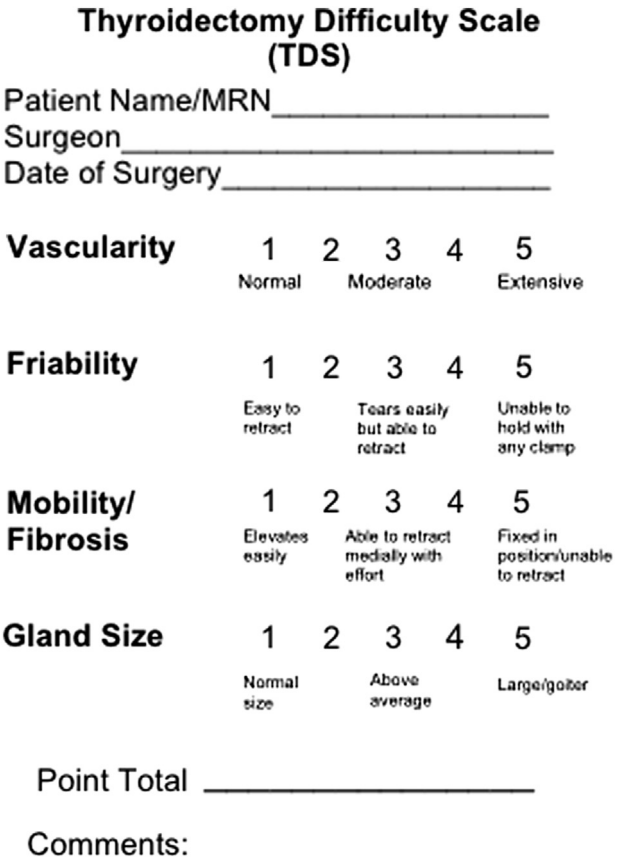

Fig. 1 – TDS Score Sheet. The surgeon completed this form after a thyroidectomy. The TDS includes four items: vascularity, friability, mobility or fibrosis, and gland size. Each item is scored on a five-point scale.

2. Methods

This study involved patients undergoing thyroidectomy by three endocrine surgeons at a high-volume tertiary referral center between 2011 and 2013. Patient demographics, preoperative laboratories, medications, comorbidities, and postoperative complications were obtained from the prospectively maintained institutional review board–approved endocrine surgery database. Surgeons completed the 20-point TDS after the thyroid operation (Fig. 1). The difficulty scale includes the following four factors: vascularity, friability, mobility or fibrosis, and gland size. Each factor was graded on a scale from 1–5 with one indicating minimal or normal, and five indicating extensive or significant involvement. An overall score of 20 would indicate the most DT [3]. Patients undergoing concomitant neck dissection, parathyroidectomy, or reoperative thyroidectomies were excluded. Thyroid cancer patients who underwent a central neck lymph node dissection were excluded because their procedures would have a longer operative time. All thyroid cancer patients were grouped together and their histologic classifications were not included in the study. Patients undergoing lobectomy were included in the study, but to account for the difference in time, their operative times were doubled. Operative times were obtained from the electronic operative record and standardized to each surgeon's average time.

To categorize each patient as DT or non-difficult thyroidectomy (NDT), a threshold TDS score was determined. The threshold was chosen based on the score that best divided adjusted operating room (OR) times above and below the surgeons' average time. The patient population was divided into subgroups based on their diagnosis of hyperthyroidism, Hashimotos thyroiditis, thyroid cancer, or multinodular goiter. Hyperthyroidism was defined as a patient having thyrotropin <0.5 mIU/L [18]. A patient was defined as having Hashimotos thyroiditis if they had an antithyroid peroxidase antibody laboratory value >25 IU/mL. Laboratory values of antithyroglobulin antibody >4 IU/mL were considered positive for antithyroglobulin antibody. A thyroglobulin level >150 ng/mL was considered "high" thyroglobulin. Hoarseness, defined as voice changes after surgery, and hypoparathyroidism, defined as parathyroid hormone below 10, were defined as transient if they resolved within 6 mo and permanent if the symptoms persisted over 6 mo.

The groups were compared using the Student *t*-test or Wilcoxon rank sum for continuous variables, chi-square and Fishers exact test for categorical variables. To identify predictors of DT, a multivariate logistic regression model was constructed with significant ($P < 0.05$) variables from a univariate analysis. All statistical analyses were performed using