

# Difficult Intubation in Thyroid Surgery: Myth or Reality?

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Thyroid surgery is considered to be a risk factor for difficult airway management. We prospectively studied 324 consecutive patients undergoing thyroid surgery to investigate the incidence of difficult intubation as evaluated by the intubation difficulty scale as well as other specific predictive factors. The overall incidence of difficult intubation was 11.1% (95% CI: 7.6–14.5). Median intubation difficulty scale was 0 (25th–75th percentile: 0; 2.7). In three predefined groups (no echographic goiter, clinically palpable goiter, and impalpable goiter), difficult intubation occurred in 10% (95% CI: 4.8–17.4), 13% (95% CI: 6.5–18.4), and 11% (95% CI: 4.7–16.8) of patients, respectively, with no statistical difference among the groups. Specific predictive criteria (palpable goiter, endotheracic goiter, airway deformation, airway compression, or thyroid malignancy) were not associated with an increased rate of difficult intubation. Classical predictive criteria (mouth opening <35 mm, Mallampati III or IV, short neck, neck mobility <80°, thyromental distance <65 mm, and a retrognathic mandible) were significantly reliable in the univariate analysis as risk factors for difficult intubation.

(Anesth Analg 2006;103:965–8)

**A**irway management is a fundamental goal of anesthesiologists. Failed intubation is associated with serious complications (1). Preoperative detection of patients or procedures at risk for difficult intubation is essential (2,3). For example, ear–nose–throat surgery is considered a risk factor for difficult intubation (4). Thyroid surgery is usually considered a risk factor for difficult intubation, but this has not been widely studied. One study found an association between difficult direct laryngoscopy and goiter when accompanied by airway deformity (5). However, another study found no association between goiter and difficult intubation in patients undergoing thyroidectomy (6).

We introduced a scale to evaluate intubation difficulty, the intubation difficulty scale (IDS). This scale is based on several validated criteria associated with difficult intubation (7–9).

The aims of this study were to determine the incidence of difficult intubation using the IDS in patients undergoing thyroid surgery and to assess whether the presence of a goiter, defined as an echographically enlarged thyroid, was associated with an increased risk of difficult intubation. We also evaluated common predictive factors of difficult intubation.

## METHODS

This was a strictly observational study with no change inpatient management. After review by our local IRB, we received permission to perform this study without specific informed consent.

All patients undergoing scheduled thyroid surgery in our university hospital over an 8-mo period were consecutively enrolled in this prospective study. The only exclusion criterion was a history of difficult intubation. Intubation was performed by a senior anesthesiologist, an anesthesiology resident with at least 2 yr of training, or a certified nurse anesthetist.

Preoperative airway assessment, performed by an attending anesthesiologist, included assessment of classical risk factors for difficult intubation: Mallampati classification, interincisor gap (noted as  $\leq 35$  mm or  $> 35$  mm), thyromental distance ( $\leq 65$  mm or  $> 65$  mm), range of head and neck movement ( $\leq 80^\circ$  or  $> 80^\circ$ ), and body mass index ( $\leq 30$  or  $> 30$  kg/m<sup>2</sup>). Other clinical variables, such as the appearance of a retrognathic midface and prognathic mandibular profile and impression of short neck, were recorded.

A goiter was defined as an echographic enlargement of the thyroid. Specific variables related to the goiter were recorded: palpable or nonpalpable thyroid; presence of compressive symptoms (dysphonia, dyspnea, hoarseness, cough or change in voice); and thyroid position (cervical or endotheracic). Chest radiography was performed when the goiter was palpable or if compressive symptoms were present. Deviation of the trachea was defined as a midline deviation of more than 1 cm (6). The surgical diagnosis was recorded: toxic multinodular goiter, Grave's disease, thyroiditis, simple or multiple thyroid nodule, malignant thyroid and hematoma. Patients were classified into three

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Accepted for publication June 12, 2006.

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 DOI: 10.1213/01.ane.0000237305.02465.ee

groups: patients without goiter on echography, patients with a palpable goiter, and patients with clinically impalpable goiter confirmed by echography. Timing of the surgery was also recorded: first operation or reoperation on the thyroid. In the latter group, surgery was to complete a total or subtotal thyroidectomy for malignant thyroid found by the pathologist.

Each patient was premedicated with hydroxyzine (1.5 mg/kg) 1 h before surgery. In the operating room, patients were monitored with noninvasive blood pressure, pulse oximetry, electrocardiogram, and measurement of end-tidal carbon dioxide. After administration of oxygen by mask, anesthesia was induced with remifentanyl (infusion of  $0.5 \mu\text{g} \cdot \text{kg}^{-1} \cdot \text{min}^{-1}$  during 1 min) and propofol (bolus of 2.5 mg/kg) without neuromuscular blockade. Patients' tracheas were orally intubated using a Macintosh No. 3 blade with the head in the sniffing position.

Intubation difficulty was assessed using the IDS (10). The IDS is a combination of seven criteria that have been associated with difficult intubation: 1) number of intubation attempts, 2) number of operators, 3) number of alternative techniques, 4) Cormack Grade minus 1 (Grade I = 0, Grade II = 1, Grade III = 2, Grade IV = 3), 5) lifting force required to make laryngoscopy, 6) necessity of laryngeal pressure, and 7) position of vocal cords. A score of 0 indicates easy intubation, a score from 1 to 5 indicates a slightly difficult intubation, and a score more than 5 indicates moderate to major difficulty. The intubation duration was recorded from the moment the laryngoscope blade touched the patient to the moment that the endotracheal tube cuff was inflated.

Statistical analysis was performed with Stat-View (Abacus Concepts, Berkeley, CA). The distribution of the IDS score is non-Gaussian. Thus, we used non-parametric tests for comparisons and correlations among the various evaluations. Values are given as mean  $\pm$  SD for Gaussian variables and as median (25th; 75th percentiles) for non-Gaussian variables, percentages or number of patients. A *P* value  $<0.05$  was considered statistically significant.

## RESULTS

Three hundred twenty-seven patients were consecutively enrolled from January 2002 to August 2002. Three patients were excluded because of a history of difficult intubation. The majority of the 324 remaining patients were females (sex ratio = 73 males for 251 females). Demographic and surgical data are shown in Table 1.

The median IDS was 0 (25th; 75th percentiles: 0; 2.7), and the overall incidence of difficult intubation defined as an IDS  $>5$  was 11.1% (36 of 324, 95% CI: 7.69–14.5). The highest IDS value was 16; 51.5% (167 of 324, 95% CI: 46.1–57) of the intubations were performed without difficulty (IDS = 0). The mean time to intubate was  $58 \pm 5$  s. The longest time to intubate was 20 min.

**Table 1.** Demographic Characteristics of the Cohort and Incidence of Difficult Intubation

Variables	All patients (n = 324)
Age (yr)	51.5 $\pm$ 13.1
Sex (M/F)	73/251
BMI (kg/m <sup>2</sup> )	24.1 $\pm$ 0.6
First time operation	308
Reoperative thyroid	16
No goiter	101 (31)
Palpable Goiter	120 (37)
Impalpable Goiter	103 (31)
Overall incidence of DI (%)	11.1
Incidence of DI per groups (%)	
No goiter	9.9
Goiter group (palpable or impalpable)	11.7
Palpable goiter	10.7
Impalpable goiter	12.5

Values inside parentheses are percentages.

DI = difficult intubation; BMI = body mass index.

One hundred one patients were in the nongoiter group, 103 patients in the nonpalpable goiter group, and 120 patients in the palpable goiter group. The incidence of difficult intubation among these three groups is reported in Table 1. When a goiter was present, the overall incidence of difficult intubation occurred in 11.7% of patients (95% CI: 7.4–15.9) with no statistical difference among the three groups (Table 1).

We have identified several risk factors for difficult intubation. Mallampati class III or IV, decreased mouth opening, decreased neck movement, short thyromental distance, short neck, and a retrognathic mandible were associated with an IDS  $>5$  (Table 2). Body mass index was more than 30 kg/m<sup>2</sup> in 45 patients and was not associated with an increased intubation difficulty, nor was gender (Table 2).

In the goiter group, tracheal deviation was observed on the chest radiography in 38 cases (17%, 95% CI: 12.1–22) and was not associated with difficult intubation, even when compressive signs were present (20 cases, 8.9%, 95% CI: 5.5–13.5). Palpation of a goiter was not associated with an increased risk of difficult intubation. Endothoracic goiter occurred in six patients (2.6%, 95% CI: 0.9–5.8), and among them, two patients were difficult to intubate, but this finding had no statistical difference (*P* values, NS).

Delayed thyroid reoperation to complete thyroidectomy occurred in 16 patients and was not associated with an increase risk of difficult intubation (Table 3).

## DISCUSSION

In our study, the overall rate of difficult intubation (IDS  $> 5$ ) in thyroid surgery was 11.1%. In a previously published study, also using the IDS, the rate of difficult intubation among the 1171 patients scheduled for general surgery was 8% (7). We found that, in

**Table 2.** Statistical Analysis of Nonspecific Predictive Factors of Difficult Intubation

Variables	Easy intubation or slightly difficult IDS ≤ 5 group (n = 288)	Moderate or difficult intubation IDS > 5 group (n = 36)	P value
Body mass index >30 kg/m <sup>2</sup>	37 (12.8)	8 (22.2)	NS
Sex (M/F)	64/224	9/27	NS
Interincisor gap <35 mm	56 (19.4)	15 (41.6)	<0.001
Mallampati III or IV	23 (7.9)	11 (30.5)	<0.001
Short neck	55 (19)	17 (47.2)	<0.001
Neck mobility <80°	48 (16.6)	15 (41.6)	<0.001
Thyromental distance <65 mm	33 (11.4)	12 (33.3)	<0.001
Retrognathic	6 (2)	6 (16.6)	<0.001

Values inside parentheses are percentages.

IDS = Intubation difficulty Score; NS = not statistically significant.

**Table 3.** Statistical Analysis of Specific Predictive Factors of Difficult Intubation

Variables	IDS ≤ 5 group (n = 288)	IDS > 5 group (n = 36)	P value
Simple or multiple thyroid nodule	67 (23.2)	4 (11)	NS
Toxic multinodular goiter	190 (65.9)	24 (66.6)	NS
Grave's disease	7 (2.4)	1 (2.7)	NS
Malignant goiter	12 (4.1)	3 (8.3)	NS
Thyroiditis	10 (3.4)	2 (5.5)	NS
Hematoma	2 (0.6)	2 (5)	NS
Positive palpation	103 (35.7)	17 (47.2)	NS
Tracheal deviation	32 (11.1)	6 (16.6)	NS
Compression signs	19 (6.5)	1 (2.7)	NS
Endothoracic goiter	4 (13.8)	2 (5.5)	NS

Values inside parentheses are percentages.

IDS = intubation difficulty score; NS = not statistically significant.

thyroid surgery, the presence of a goiter did not increase the risk of difficult intubation when compared with patients without goiter. A goiter associated with airway deformity, compressive signs, or endothoracic position was also not associated with increased intubation difficulty, nor was the presence of a malignant thyroid.

Our data are concordant with the surprising results from a study concerning difficult intubation in thyroid surgery for patients with a goiter (6). In this study using the IDS, Bouaggad et al. showed that in a population of 320 patients undergoing thyroidectomy for goiter, the incidence of difficult intubation was only 5.3%. Nevertheless, the authors found an increase in difficult intubation only when malignant thyroid was present. In our study, the presence of thyroid malignancy was not related to an increased intubation difficulty, as the incidence of such difficulty among this group of patients was not significantly different from the control group. The main limitation of the study of Bouaggad et al. (6) is that there was no control group. In our study, difficult intubation in goiter patients was compared with those without goiter.

Another study showed an increase of difficult intubation when goiter was associated with airway deformity in the general population (5). In this prospective study of patients undergoing thyroidectomy, the incidence of difficult intubation, defined as a Cormack

Grade III or IV on direct laryngoscopy, was 8.5% (5). Nevertheless, few studies found a very strong discrepancy between difficult laryngoscopy and difficult intubation (11). In fact, most patients with Cormack grade III were easy to intubate (7).

Our study has some limitations. For example, the size of the goiter was not quantified, although the easiest way of assessing goiter volume is by using echography. There was a large interindividual variability between ultrasonographers in our population and data were not analyzable. As an alternative, palpability of the thyroid is a good clinical determinant, and we evaluated this as a predictive factor for difficult intubation. Unfortunately, clinical palpation is not always reliable. In our study, for instance, we found nonpalpable thyroids where there was echographic evidence of a goiter.

Another limitation of our study was that a few of our endotracheal intubations were performed by inexperienced laryngoscopists (anesthesiology residents). This fact may have had an effect on total intubation score. Nevertheless, we have performed a comparison of IDS distribution among our investigators (i.e., seniors versus residents and nurses), and no significant difference has been found (results not shown).

In conclusion, we found that thyroid surgery was not associated with an increased incidence of difficult intubation. In this selected population of patients, we

could not find any specific predictive risk factor for difficult intubation related to goiter disease. In contrast, only the usual preoperative criteria for difficult intubation used in the general population were reliable.

#### ACKNOWLEDGMENTS

*The authors thank Drs. Jane Torrie, Joana Dorsett and Pierre Rougé for their invaluable assistance in preparing this manuscript.*

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