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ORIGINAL RESEARCH

CORRELATION OF DIFFICULTY IN TRACHEAL INTUBATION WITH VARIOUS FACTORS FROM THE PREOPERATIVE EVALUATION IN PATIENTS WITH THYROID SWELLING UNDERGOING THYROIDECTOMY: A PROSPECTIVE OBSERVATIONAL STUDY

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Abstract

Aim: Correlation of difficulty in tracheal intubation with various factors from the preoperative evaluation in patients with thyroid swelling undergoing thyroidectomy

Methodology: We conducted a prospective observational study after approval from Institutional ethics committee. Total 60 consenting patients with thyroid swelling undergoing thyroidectomy were included in the study. A standard OT protocol for routine pre anaesthetic check up was followed. The usual airway parameters such as mouth opening, Mallampati classification (MPC), slux, thyromental distance (TMD), were assessed. The euthyroid status of the patient was confirmed.

Results: 38 (63.3%) of patients had benign swelling and 22 (36.6%) had malignant swelling on FNAC. Highest percentage of patients 27 (45%) had MPC class 1 during airway assessment followed by 18 (30%) in class 2, 11 (18.3%) and 4 (6.7%) in MPC class 3 and 4 respectively. So total 75% patients had MPC 1 & 2, that predicts easy intubation. 26(43.3%) of patients had deviation of trachea to the left, 12 (20%) had deviation to right and 4(6.7%) had compression of trachea

3 (5%) patients had both tracheal deviation and compression. Highest percentage of patients 48.3% (29) were intubated in 15-30sec, 13 (21.6%). patients required 30-45 sec, 12 (20%) required less than 15 sec, while 6 (10%) patients required more than 45 sec. Maximum time required for intubation was 58 sec.

Conclusion: Thyroid swelling accompanied with airway deformity is a risk factor for difficult intubation. A thorough preoperative history in all patients with thyroid swelling is mandatory and should include duration of thyroid swelling, pressure symptoms and radiological investigations of the neck and thorax.

Keywords: tracheal, intubation, thyroidectomy

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Introduction

Thyroidectomy is the most common endocrine surgery performed. Airway management may be difficult despite a normal airway examination due to impingement of a thyroid mass on the laryngeal and tracheal structures. Anaesthetists must be prepared to use emergency airway adjuncts in case a patient cannot be ventilated or intubated. [1].

Most of the information concerning anaesthetic management is limited to isolated case reports and small case series. A recent prospective study on difficult airway in patients undergoing thyroidectomy from a goitre-endemic region (Ethiopia), reported a difficult intubation incidence of 14.3% and concluded that goitre associated with airway compromise is a major risk factor [2].

The commonest implications during such procedures involve the management of a potential difficult airway, especially in cases of retrosternal goitre and an enlarged thyroid gland compressing over the trachea for a prolonged duration.[2,3] The complexity of surgical intervention also adds to these existing challenges as the procedure may vary from simple excision of a thyroid nodule to removal of a large gland which may have a retrosternal extension.[4]

A thorough preoperative evaluation helps in selecting a proper method of securing airway [5] and reduces the airway related morbidity.

We undertake this study to establish the correlation between preoperative evaluation of patient presented with thyroid mass and difficulties faced by concerned anaesthesiologist during airway management of same group of patients.

Methodology

We conducted a prospective observational study after approval from Institutional ethics committee. Total 60 consenting patients with thyroid swelling undergoing thyroidectomy were included in the study. Patients with any coexisting obvious airway deformity or airway tumors in addition to thyroid swelling were excluded.

A standard OT protocol for routine pre anaesthetic check up was followed. The usual airway parameters such as mouth opening, MPC, slux, thyromental distance (TMD), were assessed. The euthyroid status of the patient was confirmed.

In addition, an elaborate airway assessment was carried out. This included history, local examination of the swelling and radiological evaluation of the airway. Other specific investigations such as PFTs or ABG if carried out were noted.

Preoperative Airway Assessment related to thyroid swelling

History

- **Duration of thyroid swelling**: A large-sized goiter present for a prolong duration makes the patient a potential candidate for developing tracheomalacia.
- **History of pressure symptoms** such as dyspnoea, dysphagia, stridor, hoarseness of voice, giddiness in sitting as well as in supine position. Ability of the patient to sleep in the supine position in the night as well as preference for a particular position were noted.
- **A sudden and rapid increase in the size** of the goiter: It may indicate either hemorrhage within the tumour or rapidly enlarging malignancy that can cause difficult airway.

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Examination

- Signs of airway distress such as use of accessory muscles of respiration, tachypnea.
- Neck movements
- Size, consistency and extent of swelling.
- Ability to palpate the lower border of thyroid gland (getting below the swelling).
- Ability to palpate trachea and its position.

Investigations and Laboratory findings related to airway were noted such as

- Indirect laryngoscopy for all patients and/or rigid laryngoscopy in certain cases.
- Pulmonary function test (PFT) when performed, in patients with respiratory symptoms.
- ABG whenever prescribed

Radiological investigations such as

- Chest X-ray (PA view)
- X-ray neck, anterio-posterior and lateral view
- In case of a very large-sized thyroid gland, retrosternal extension and symptomatic goiter, computed tomography (CT) scan or magnetic resonance imaging (MRI), if done, were noted to delineate the exact location and extension of thyroid swelling and pressure effects on surrounding structures.

Anesthesia Technique used, was at the discretion of the consultant anesthesiologist The technique followed in each case was noted.

During airway management following factors were noted

The difficulty in tracheal intubation was assessed by

1. Cormack Lehane grading at laryngoscopy
2. Number of attempts required
3. Number of operators
4. Need for extra laryngeal maneuver
5. Time taken for intubation
6. Need for special airway gadget
7. Operator evaluation for ease of intubation

The position of endotracheal tube placement was confirmed by capnography and auscultation.

Difficulty in tracheal intubation was correlated with various factors from the preoperative evaluation such as

1. Presence of pressure symptoms (dyspnea / dysphagia)
2. Size of gland
3. Type of thyroid swelling (solitary nodule/ MNG/ malignancy)
4. Tracheal deviation
5. Tracheal compression
6. Retrosternal extension

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Statistical analysis

Data was entered into Microsoft Excel (Windows 7; Version 2007) and analyses were done using the Statistical Package for Social Sciences (SPSS) for Windows software (version 22.0; SPSS Inc, Chicago). Descriptive statistics such as mean and standard deviation (SD) for continuous variables, frequencies and percentages were calculated for categorical Variables were determined. Association between Variables was analyzed by using Chi-Square test for categorical Variables. Bar charts and Pie charts were used for visual representation of the analyzed data. Level of significance was set at 0.05.

Result and observation

Table 1: Distribution of Study Subjects according to their Age Group (N = 60)

Age (in Years)	No.	Percent
≤ 20	3	5.0
21-30	17	28.3
31-40	17	28.3
41-50	12	20.0
51-60	10	16.7
>60	1	1.7
Mean (SD)	38.13 (12.75)	
Range	14-65	

The mean age ± SD was 38.13±12.75 years and highest percentage of patient was found in age group 21-30 years (28.3%) and 31-40 years (28.3%), followed by 20% in age group 41-50 years. Only one patient was beyond 60 years of age.

Table 2: Distribution of Study Subjects according to the Gender (N=60)

Gender	No.	Percent
Male	7	11.7
Female	53	88.3

Above table shows gender distribution. There was preponderance of female patients 53 (88.3%) as compared to males 7 (11.7%).

Table 3: Distribution of Study Subjects according to FNAC (N=60).

FNAC	No.	Percent
Total Benign	38	63.3
Total Malignant	22	36.6

- 38 (63.3%) of patients had benign swelling and 22 (36.6%) had malignant swelling on FNAC

Table 4: Distribution of Study Subjects according to the MPC (N=60)

MPC	No.	Percent
Class 1	27	45.0
Class 2	18	30.0
Class 3	11	18.3
Class 4	4	6.7

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Highest percentage of patients 27 (45%) had MPC class 1 during airway assessment followed by 18 (30%) in class 2, 11 (18.3%) and 4 (6.7%) in MPC class 3 and 4 respectively. So total 75% patients had MPC 1 & 2, that predicts easy intubation.

Table 5: Distribution of Study Subjects according to the History & Clinical Examination (N=60)

Clinical Examination	No.	Percent
Dysphagia for solids	3	5.0
Dysphagia for liquids	8	13.3
Dyspnoea	11	18.3
Dysphagia & Dyspnoea	6	10.0
Rapid increase in size	3	5.0
Hoarseness of Voice	8	13.3
Not Able to lie supine	4	6.7
Not able to palpate lower border	13	21.7
Not able to palpate trachea	13	21.7

- 3 (5%) of patients had complaint of dysphagia for solids and 8 (13.3%) had dysphagia for liquids, none of the patient had both dysphagia for solids and liquids together.
- 11 (18.3%) patients had complaint of dyspnoea and 4(6.7%) were not able to lie supine.
- 6 (10%) patients had history of dysphagia & dyspnoea both.
- 8 (13.3%) of patients had history of hoarseness of voice.
- 3 (5%) of patients had history of rapid increase in size of welling.
- In 13 (21.7%) of patients it was not possible to palpate the lower border of the swelling and trachea.
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Table 6: Distribution of Study Subjects according to duration of swelling (N=60)

Duration of swelling (years)	No.	Percent
<1	15	25.0
1-2	23	76.6
2-5	15	25.0
>5	7	11.6
Mean (SD)	5.56(1.68)	
Range	2months – 30 years	

- The mean duration of swelling was 5.56±1.68 years. Highest percentage of patients 23(76.6%) had duration of swelling 1-2 year, followed by 15 (25%) had duration of swelling <1 year and 2-5 years. 7(11.6%) patients had duration of swelling more than 5 years. **The maximum duration was 30 years.**

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Table 7: Distribution of Study Subjects according to the X-Ray Neck Findings (N=60)

X Ray Neck	No.	Percent
Tracheal Deviation to Left	26	43.3
Tracheal Deviation to Right	12	20.0
Tracheal Compression	4	6.7
Tracheal deviation & compression	3	5
No Deformity	21	35

26(43.3%) of patients had deviation of trachea to the left, 12 (20%) had deviation to right and 4(6.7%) had compression of trachea 3 (5%) patients had both tracheal deviation and compression

Table 8: Distribution of Study Subjects according to the CT Scan Findings (N=60)

CT Scan Findings	No.	Percent
Tracheal Deviation	24	40.0
Tracheal Compression	4	6.7
Retrosternal Extension	3	5.0
Tracheal deviation & compression	3	5.0
No Deformity	7	11.6
CT scan Not done	28	46.6

- 24 (40%) patients had tracheal deviation and 4 (6.7%) had tracheal compression.
- 3 (5%) patients had retrosternal extension.
- 7 (11.6%) patient didn't have any deformity on CT scan.
- 28 (46.6%) patients didn't get the CT scan done.

Table 9: Distribution of Study Subjects according to the CL Grading (N=60)

CL Grading	No.	Percent
1	13	21.7
2	25	41.7
3a	12	20.0
3b	10	16.7

Highest percentage of patients 25 (41.7%) had CL grade 2, followed by 13 (21.7%) had CL grade 1. 12 (20%) and 16.7% (10) had CL grade 3a and 3b respectively. None of the patients had CL grade 4.

Table 10: Distribution of Study Subjects according to the Number of Attempts for intubation (N=60)

Number of Attempts	No.	Percent
1	40	66.7
2	17	28.3
3	3	5.0

- 40 (66.7%) were intubated in 1st attempt.

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- 17 (28.3%) were intubated in 2nd attempt.
- 3 (5%) were intubated in 3rd attempt.

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Table 11: Distribution of Study Subjects according to the Number of Operators (N=60)

Number of Operators	No.	Percent
1	44	73.3
2	14	23.3
3	2	3.3

- 44 (73.3%) of patients required only 1 operator.
- 14 (23.3%) of patients were intubated by 2nd operator.
- 2 (3.3%) of patients were intubated by 3rd operator.

Table 12: Distribution of Study Subjects according to the Need of external laryngeal maneuvre (ELM) (N=60)

Need of ELM	No.	Percent
Yes	16	26.7
No	44	73.3

16 (26.7%) of patients required external laryngeal manoeuvre whereas 44 (73.3%) didn't require external laryngeal manoeuvre.

Table 13: Distribution of Study Subjects according to the Time for Intubation (N=60)

Time for Intubation (sec)	No.	Percent
<15	12	20.0
15-30	29	48.3
30-45	13	21.6
>45	6	10

Highest percentage of patients 48.3% (29) were intubated in 15-30sec, 13 (21.6%) patients required 30-45 sec, 12 (20%) required less than 15 sec, while 6 (10%) patients required more than 45 sec. Maximum time required for intubation was 58 sec.

Table 14: Comparison of Various Parameters with CL grading (N=60)

Parameter	Easy Intubation (n=38) Mean (SD)	Difficult Intubation (n=22) Mean (SD)	P Value
Age (in Years)	34.13 (12.05)	45.05 (11.03)	0.001*
Size of Swelling (sq cm)	36.98 (45.30)	74.81 (5.200)	0.005*
Duration of Swelling (yrs)	3.14 (5.23)	4.14 (5.08)	0.473
Unpaired t Test, P Value * Significant			

- Mean age in easy intubation group was found to be 34.13±12.05 years and in difficult intubation group was 45.05±11.03 year, with statistically significant P Value (0.001).
- Mean size of swelling in easy intubation group was found to be 36.98±45.30 sq cm and in difficult intubation was found to be 74.81±5.20 sq cm, with statistically significant P Value (0.005).

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- Mean duration of swelling was not found to be statistically significant.

Table 15: Association of Goitre Related Risk factors with Difficult Intubation (N=60)

Goitre Related Factors	Easy Intubation (n=38) n (%)	Difficult Intubation (n=22) n (%)	P Value
Dysphagia			
For liquids	2 (5.3)	6 (27.3)	0.050*
For solids	2 (5.3)	1 (4.5)	
None	34 (89.5)	15 (68.2)	
Dyspnoea			
Yes	5 (45.5)	6 (55.5)	0.173
No	33 (67.3)	16 (32.7)	
Ability to lie Supine			
Yes	37 (66.1)	19 (33.9)	0.099
No	1 (25.0)	3 (75.0)	
Ability to palpate lower border			
Yes	34 (72.3)	13 (27.7)	0.006*
No	4 (30.8)	9 (69.2)	
Ability to palpate trachea			
Yes	34 (72.3)	13 (27.7)	0.006*
No	4 (30.8)	9 (69.2)	
Sudden Increase in size			
Yes	0	3 (100.0)	0.020*
No	38 (66.7)	19 (33.3)	
Tracheal Deviation			
Yes	15 (62.5)	9 (37.5)	0.912
No	23 (63.9)	13 (36.1)	
Tracheal Compression			
Yes	2 (50.0)	2 (50.0)	0.566
No	36 (64.3)	20 (35.3)	
Retrosternal Extension on CT			
Yes	2 (66.7)	1 (33.3)	0.902
No	36 (63.2)	21 (36.8)	
Chi-Square Test, P Value *Significant			

- 2 (5.3%) patients had dysphagia for liquids and 2 (5.3%) patients had dysphagia for solids, 34 (89.5%) patients did not have dysphagia for solids and liquids in easy intubation group. 6 (27.3%) patients had dysphagia for liquids, 1 (4.5%) had dysphagia for solids and 15 (68.2%) didn't have dysphagia for solids and liquids in difficult intubation group. P Value was found to be statistically significant (0.050).

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- 34 (72.3%) patients lower border of swelling could be palpated and 4 (30.8%) patients lower border of swelling couldn't be palpated in easy intubation group. 13 (27.7%) patients lower border of swelling could be palpated and 9 (69.2%) patients lower border of swelling couldn't be palpated in difficult intubation group. P Value was found to be statistically significant (0.006).
- 34 (72.3%) patients trachea could be palpated and 4 (30.8%) patients trachea couldn't be palpated in easy intubation group. 13 (27.7%) patients trachea could be palpated and 9 (69.2%) patients trachea couldn't be palpated in difficult intubation group. P Value was found to be statistically significant (0.006).
- None of the patients had sudden increase in size of swelling and 38 (66.7%) didn't have sudden increase in size in easy intubation group. 3 (100.0%) patients had sudden increase in size and 19 (33.3%) didn't increase in size in difficult intubation group. P Value was found to be statistically significant (0.020).

Other factors like history of dyspnoea, inability to lie supine, tracheal deviation and compression and retrosternal extension on CT were not found to be statistically significant in our study.

Discussion

Demographic data age

The mean age was 38.13±12.75 years, majority of the patients were in age group 21- 40 years (56.6%) [**Table 1**] .Mean age in difficult intubation group was 45.05±11.03 years and easy intubation group was 34.13±12.05 years and the difference was found to be statistically significant [P=0.001]. This is similar to the study by **Amare Gebregzi Hailekiros et al. (6)** where 56% of patients were in age group 21-40 years. Association of age with difficult airway was found in the age groups above 40 (P=0.011).

Gender

Thyroid related disorders are common in females as compared to male. In our study also showed female preponderance. There were 53 (88.3%) female patients and 7 (11.7%) male patients. Of 53 female patients, 18 (33.9%) had difficult intubation and of 7 male patients, 4 (57.1%) had difficult intubation. [**Table 2**]. **Abderrahmane Bouaggad et al. (2)** found significant association between male sex and difficult intubation. **R. Amathieu et al, (7)** stated in their study that there was no association between gender and difficult intubation. As seen in study done by **Mark P. J. Vanderpump et al. (8)** the greatest prevalence of goitre was seen in pre-menopausal women, and the ratio of women to men is at least 4:1. **VanderJB et al. (9)** studied thyroid related disorder in Framingham and found that clinically apparent thyroid nodules were present in 6.4% of women and 1.5% of men.

MPC

MPC is considered as one of the most important predictor of difficult intubation. **Abderrahmane Bouaggad et al. (2)** concluded in their study that thyroid swelling along with MPC class III & IV on airway examination was associated with difficult intubation, which was found to be statistically significant (P<0.001). On the other hand, **Juvin et al (10)**

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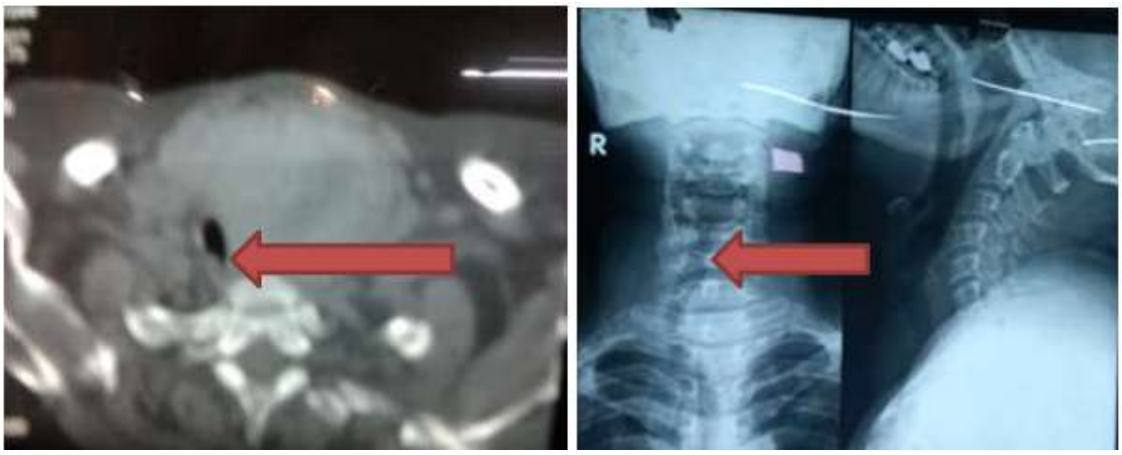
found that sensitivity, specificity and negative predictive value was less for MPC. The wide variation in reported sensitivity and specificity could be due to inter –observer variability, change in class of visualisation with phonation which usually occurs involuntarily and poor demarcation of various classes of MPC. In our study 75% of patients had MPC Class I or II predicting easy intubation and 25% of patients had MPC class III or IV predicting easy intubation [**Table 4**]. In our study also, we found statistically significant association between higher MPC grade and high CL grade.

Goitre Related Risk factors associated with Difficult Intubation.

Thyroid enlargement was defined clinically as the ability to palpate the goitre **(6)** (a normal thyroid gland is not palpable). The size of the goitre was measured (in millimetres), with the neck fully extended, both from front and from behind. Help of surgical colleagues was taken for the same. An attempt was made to palpate the trachea and also to locate its position and deviation if any, on either side. The lower border was palpated for the possibility of retrosternal extension. The evaluation was completed by indirect laryngoscopy by an ENT surgeon and radiographs of the neck and chest to determine the presence of any anatomical deformity like tracheal deviation and compression. A CT scan was ordered in symptomatic patients for airway compression and patient with big thyroid swelling.

Figure 1: CT and X-Ray showing tracheal deviation



WHO has classified goitre according to the size(11)

Class 0 - palpable mass within the neck structure,

Class I - visible, palpable swelling that undermines the curves and the neckline,

Class II - a very large goitre with retrosternal extension that causes tracheal deviation, compression of trachea and oesophagus.

Large thyroid gland causes anatomical distortion of airway in form of tracheal deviation or compression and is commonly associated with compressive symptoms like dysphagia & dyspnoea. In our study mean size of thyroid swelling was 74.81 ±11.03 sq cm and greater was found to be associated with difficult intubation [p=0.005]. On contrary in a study published by **Bartolek et al (12)** concluded that large goitre may not be always associated with difficult intubation. They found that cancerous goitre associated with compressive symptoms and CL grade III & IV were important risk factors for difficult intubation.

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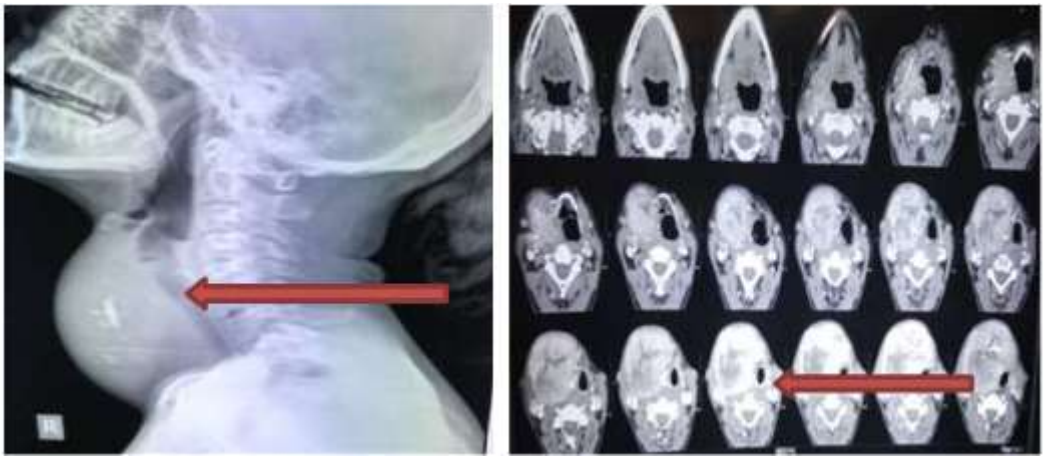
Abderrahmane Bouaggad et al. (2) also concluded that size of thyroid swelling was not associated with difficult intubation.

Figure 2: CT and X-ray showing tracheal compression



In our study, compressive symptoms like dyspnoea, dysphagia and dysphonia were noted, but apart from dysphagia [p=0.05], dyspnoea & dysphonia were not associated with difficult intubation. On contrary **Amare Gebregzi Hailekiros et al.**.[(6)] found that neither dysphagia, dyspnoea nor dysphonia were associated with difficult intubation. Whereas **Abderrahmane Bouaggad et al. (2)** concluded that presence of dyspnoea during preoperative examination was significantly associated with difficult intubation ($P < 0.001$), while dysphagia and dysphonia was not associated with difficult intubation. All these studies differ in their results with respect to the association of airway difficulty and presence of compressive symptoms. However, if all studies are to be considered together, presence of either of the three symptoms should make one suspicious about the possibility of difficult airway and take the necessary precautions.

It is important to elicit the history of breathlessness in supine position. as the anaesthesia inductions are carried out in supine position. The patient may not be symptomatic in sitting position as the thyroid swelling falls away from trachea, however, in supine position, the patient may become symptomatic as the swelling causes direct pressure on the trachea causing patient to be symptomatic, especially during sleep as the voluntary muscles of respiration are not active. In our study, 4 patients had history of ability to lie supine due to compressive effect of enlarged thyroid on airway, of these, 3 (75%) patients had difficult intubation. [p=0.099]. **Kirti Nath Saxena et al. (13)** published a case report of a female with large multi-modular goitre who had difficulty in breathing in supine position due to compressive effect of thyroid gland. Awake FOI in sitting position was planned for this patient, who was intubated in sitting position after anesthetizing upper airway with local anaesthetic agent and then patient was made supine and general anaesthesia was induced.

Not able to get below the swelling and inability to palpate trachea were associated with difficult intubation [P=0.006]. **R. Amathieu et al (7)** found 11.7% of palpable goitre and 12.5% of impalpable goitre had difficult intubation.

Abderrahmane Bouaggad et al. (2) found association of cancerous goiter, tracheal deviation or compression with difficult intubation, whereas no significant association was seen between mouth opening, receding mandible and size of thyroid.

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Abebe et al. **(14)** found in their study that average duration of illness was around 8.8 years. In our study, mean duration of thyroid swelling was 5.56±1.68 years. The duration had significant correlation with size of thyroid swelling but not with difficult intubation. So bigger size does not necessarily leads to difficult intubation.

On X-ray Neck, 38(63.3%) patients had tracheal deviation [**Table 7**], 68% of patients had left lateral deviation of trachea and 46% of patients required external laryngeal manoeuvre during intubation. 4 patients had tracheal compression of which 50% of had difficult intubation. At the same time, 20 patients who had difficult intubation did not show tracheal compression. 3 patients had tracheal deviation and compression both. Tracheal deviation and compression were not associated difficult intubation in our study. **R. Amathieu et al. (7)** also got the same finding in their study that a goiter associated with airway deformity, compressive signs, was also not associated with increased intubation difficulty. On the contrary, **Amare Gebregzi Hailekiros et al. (2)** found that tracheal deformity (deviation of the trachea>1cm on chest x-ray) were the only independent predictive risk factors for difficult airway in the presence of goitre. They also concluded that

deviation of the trachea to be a strong predictor of Cormack & Lehane III/IV.

G A Dempsey et al. (15) studied 19 patients with massive retrosternal goitre, found that despite of tracheal deviation and tracheal narrowing, all the patients were intubated with conventional size endotracheal tube. Patients with significant narrowing of trachea were managed similar to the other patients. This is because tracheal narrowing in most of the patient is due to extrinsic compression rather than infiltrative process. None of the patient had difficult positive pressure ventilation after intubation of trachea. **R. Amathieu et al. (7)** also stated that endo- thorasic position of thyroid gland was not associated with increased difficulty of endotracheal intubation. Another factor that explains the relatively easy intubation in spite of radiological evidence of deviation and compression is that different modes and techniques of anaesthesia induction and advanced airway gadgets were used appropriate for each patient. we did not use a standard anaesthesia for all patients but it was tailor made to suit individual patient.

36.6% of patients had malignant thyroid swelling [**Table 3**] and 90% of them had difficult tracheal intubation. This was consistent with the finding of **Abderrahmane Bouaggad et al. (2)** who found that the presence of a cancerous goitre is a major factor for predicting difficult endotracheal intubation. It is because cancerous goitre are detected at advanced stage when they are associated with compressive symptoms. Difficult intubation is due to tracheal infiltration by cancerous tissue resulting in fibrosis and reduced mobility of laryngeal structure. Similar finding was seen in **Abebe et al**.

(14) who reported that the commonest reasons for seeking medical attention being bulk of the mass (82%) and rapid growth (9.5%).10.2% of the cases had malignant thyroid swelling, Follicular carcinoma was the most common type of malignancy. On contrary, **R. Amathieu et al. (7)** did not find any association between malignant thyroid swelling and difficult intubation.

Majority of the patients were CL grade I & II on direct laryngoscopy who were easy to intubate [**Table 9**]. 36.7% of patients were CL grade III who were associated with difficult intubation as these patients' required more than one attempt and longer duration for intubation**.** Similar result was seen in study done by **Abderrahmane Bouaggad et al. (2)**

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where CL grade III & IV were associated with difficult intubation (P<0.001). On contrary **R. Amathieu et al**. found that most of the patients with CL grade III were easy to intubate.

In this study 22 (36.6%) patients had difficult intubation that is CL III & IV on direct laryngoscopy. There were no failed intubations, and no difficulty was encountered in passage of the endotracheal tube through the compressed or narrowed portion of the trachea. 17 were intubated in 2^{nd} attempt while 3 patients required 3 attempts for endotracheal intubation [**Table 10**]. 14 patients were intubated by 2^{nd} operator and 3 patients were intubated by 3^{rd} operator [**Table 11**]. 16 of them required external laryngeal manoeuvre (ELM) for intubation [**Table 12**].

Abderrahmane Bouaggad et al. (2) Found in their study that 17 patients in whom tracheal intubation was recorded as difficult (IDS >5), tracheal intubation was successful, with more than 2 laryngoscopies and more than 1 operator. All patients in whom tracheal intubation was difficult were managed effectively as follows: in 10 patients, the trachea was intubated with laryngeal pressure to improve the laryngoscopic view, and in 7 patients, tracheal intubation was achieved after repositioning the patient and using Miller laryngoscope blades with stylet or Magill forceps. **R. Amathieu et al(15)** the overall incidence of difficult intubation defined as an IDS >5 was 11.1% (36 of 324), The highest IDS value was 16; 51.5% (167 of 324, 95% CI: 46.1–57) of the intubations were performed without difficulty. The mean time to intubate was 58± 5 s. The longest time to intubate was 20 min.

The incidence of difficult intubation was found to be higher 36.6%, **Gebregzi Hailekiros et al. (6)** found the incidence of difficult intubation was 14.3%, whereas **Abderrahmane Bouaggad et al. (2)** found the incidence of difficult intubation was 5.3%. As this study was conducted in tertiary hospital most of the patients referred here were with large thyroid swelling associated with airway deformity like tracheal deviation and narrowing which lead to high incidence of difficult intubation. Difficult intubation was associated with large size of thyroid gland associated with anatomical airway deformity and malignant swelling on FNAC.

Limitations

Limitation of our study was small sample size. Since it was a prospective study, we got only 60 patients coming for thyroidectomy during the study period. Another limitation was that we relied mainly on x-ray neck reports for tracheal deviation and narrowing. The best way of determining tracheal deformity was by using a CT scan, which was not available for all the patients. It was also difficult to measure the exact size of the gland by palpating preoperatively and considering it as a predictive factor as goitre usually grows internally and we cannot determine the correct size preoperatively.

Conclusion

Thyroid swelling accompanied with airway deformity is a risk factor for difficult intubation.

A thorough preoperative history in all patients with thyroid swelling is mandatory and should include duration of thyroid swelling, pressure symptoms and radiological investigations of the neck and thorax.

A single universal technique of induction of anaesthesia and intubation may not be favourable in all circumstances and must be tailored to meet individual patient’s symptoms and anatomical and radiological variations.

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The risk factors for difficult airway in patients with thyroid swelling would be age more than 40 years, size of the swelling, presence of dysphagia, inability to palpate the lower border and inability to palpate the trachea.

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