



## Original article

# Tracheomalacia due to trachea compression related to benign goiter

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**Abstract: Introduction:** Tracheomalacia can result from long-standing compression by a large goiter. The cartilaginous rings of the trachea may be weakened or destroyed by long-standing compression, causing loss of structural support. Tracheomalacia after resectioning of benign goiter compressing trachea was an important issue. It has extended the time of mechanical ventilation, increased the risk of failure extubating and mortality.

**Materials and Methods:** Descriptive and prospective study. From November 2014 to January 2017, we have collected 102 patients who had benign goiter compressing trachea and had thyroidectomy. Tracheomalacia was diagnosed and managed intra and postoperatively. **Results:** Recognition of women accounted for the majority of 81.4%. The average age was 54.5 years old and the average duration of goiter was 5 years. The patients were hospitalized with the main symptom of dysphagia accounting for 21.6% and difficulty breathing when lying down was 16.7%. On CT scan, the average Goiter was 270g, the average narrow airway diameter was 8.4 mm, of which 12.7% of patients had narrow tracheal diameter <5mm. The rate of tracheomalacia was 4.9%. There were statistically significant differences between the 2 groups with and without tracheomalacia: elderly patients ( $p = 0.041$ ); goiter long-standing time ( $p = 0.07$ ); symptoms of positional dyspnea on lying ( $p = 0.003$ ) and tracheal diameter compressed ( $p = 0.001$ ). **Conclusion:** Tracheomalacia should be noted in patients older than 65 years old, goiter exist longer than 5 years and goiter is over 200g.

**Keywords:** Tracheomalacia, trachea compressing, benign goiter, goiter.

## 1. INTRODUCTION

Benign goiter is an abnormal enlargement of the thyroid gland. There are many types of goiter such as uninodular, multinodular or diffuse goiter. It can be associated with thyroid dysfunction in the form of hypo or hyperthyroidism. Large goiter compresses the surrounding organs, especially the trachea. The frequency of benign goiter to cause tracheal compression is less likely to be reported and varies depending on the geographical region between 8 and 37.5% [1, 2]. The clinical symptoms of the disease vary from asymptomatic to dyspnea when lying down and acute respiratory failure.

Thyroidectomy is the standard operation for the benign goiter compressing the trachea; during perioperative period,

the airway needs to be carefully controlled because tracheomalacia is one of the most severe surgical complication and prompt management (stenting, tracheopexy, tracheostomy or positive pressure, etc) of tracheomalacia prevents respiratory failure after removing the endotracheal tube [1-6]. White et al. reported that the incidence of tracheomalacia ranged from 0% to 10% [7]. Currently, there are many reports and researches on the treatment of goiter such as endoscopic surgery and radiofrequency ablation (RFA); however, there aren't enough studies reporting the incidence of clinical symptoms or treatment of tracheomalacia after thyroidectomy of goiter patients, especially in Vietnam; therefore, this study has been conducted to do discuss this issue.

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**2. MATERIALS AND METHOD**

We have conducted a descriptive analysis on 102 patients diagnosed with benign goiter compressing trachea and had thyroidectomy in the period from November 2014 to January 2017, with benign postoperative pathology results. Tracheal stenosis was diagnosed by CT scan and classified follow Euro Respiratory Organization [4].

All patients had performed preoperative thyroid function test and only patients with normal results were included. To estimate the size of goiter, patients underwent neck computed tomography and then physicians measured the mass. From these images on CT scan, the smallest cross-sectional area of the trachea was identified. All patients underwent thyroidectomy and were evaluated during the surgical period according to previous studies [5, 6]. It was observed that the compressed area was softer than the surrounding tissue, and intubation lasted longer than 6 hours postoperatively. Moreover, when failure of withdrawal of the endotracheal tube occurs, patients need to have a re-intubation which subjects them to have tracheopexy (which was done by fixing the tracheal ring by the monofilament sutures at anteriolateral corners bilaterally to periosteum of the posteriosuperior border of sternal end of the clavicle [8]) or tracheostomy after thyroidectomy. In addition, during surgery, the endotracheal tube retracts through the narrow space, and the compressed airway collapses when patients exhale.

Epidemiological characteristics, clinical pictures, information from CT scan images, and the degree of goiter postoperative pathology, and postoperative complications were collected, and are presented in Table 1. SPSS 20.0 was used for analyzing the risk factors of compressing trachea with unpaired Student t-test, significant different when  $p < 0.05$ .

All procedures performed in this study were in accordance with the ethical standards of the research committee (from medical university and hospital) following the 1964 Helsinki declaration, and the informed consent paper from each patient for sample collection were signed before operation.

**3. RESULTS**

**Table 2:** Clinical characteristics of tracheal compression group

Age/Sex	Duration of goiter (years)	Weight of mass(g)	Tracheal diameter (mm)	Surgical method	Postoperative situation	Result
62/Female	30	477	5	Tracheopexy	Withdrawal of ETT after 1h	Stable
85/Female	20	522	6	Tracheopexy	Withdrawal of ETT after 1h	Stable
37/Female	5	686	6	No	Mechanical ventilation in 6h	Stable
68/Female	10	706	5	No	Mechanical ventilation in 11h	Stable
79/Male	5	667	5	No	Fail withdrawal of ETT → Reintubation	Pneumonitis → Death

ETT: Endotracheal tube

The patients were hospitalized with the main symptom of dysphagia accounting for 21.6% and difficulty of breathing when lying down was 16.7%. Most of the patients (83.3%) had goiter degree 3. From the images of CT scan, the average weight of goiter was 270 grams and the average narrow tracheal diameter was 8.4 mm. Tracheal compression lower than 5 mm was present in 13 of 102 patients (12.7%). The most common postoperative complication was hand numbness accounting for 15.7%. Tracheomalacia was observed in 4.9 % of cases. Most of

Between November 2014 and January 2017, a total of 102 patients (81.4% female and female to male ratio is 4:1) with benign goiter underwent thyroid surgery. The mean age was 54.53 years and the mean duration of goiter was 5 years.

**Table 1:** Clinical characteristic and CT scan of patients

	Number of patients (n=102)	%
Sex		
Male	19	18.6
Female	83	81.4
Age, years	54.53 ± 13.1	
Average duration of goiter, years	5 (1;40)	
Clinical symptom		
Dyspnea when lying down	17	16.7
Dysphagia	22	21.6
Coughing	4	3.9
Degree of goiter		
Degree 1	1	0.9
Degree 2	1	0.9
Degree 3	85	83.3
Degree 4	15	14.9
Images of CT scan		
Weight of mass (gram)*	270 (76;810)	
Diameter of narrow airway (mm)	8.44 ± 2.43	
Goiter plangent	50	49
Length of stenosis area (mm)	18.13 ± 6.5	
Postoperative complication		
Tracheomalacia	5	4.9
Hoarseness	7	6.9
Numb hand	16	15.7

\* median (interquartile range)

tracheomalacia cases were female. The duration of goiter varied from 5 to 30 years. The mean tracheal diameter was 5mm. All tracheomalacia cases were diagnosed in the surgery period. 2 of 5 cases had the soft tracheal compression area and were repaired by tracheopexy. 2 of 5 the rest cases, we keep the endotracheal tube in the postoperative time. The last case failed with removing the endotracheal tube and then was reintubated, this case unfortunately got pneumonitis and died. It is noted that the correlation is statistically significant between tracheomalacia and

non-tracheomalacia; the elderly ( $p=0.041$ ); duration of goiter ( $p=0.07$ ); difficulty breathing when lying down ( $p=0.003$ ); narrow trachea ( $p=0.001$ ).

**Table 3:** Correlation between tracheomalacia and other factors

	Tracheomalacia		P
	Yes	No	
Sex			
Male	1	18	0.651
Female	4	79	
Age (years)	66.2 ± 18.6	53.93 ± 12.5	0.041
Supine breathing	4	13	0.003
Duration of goiter (years)	14 ± 10.8	7.74 ± 7.6	0.07
Tracheal diameter (mm)	5.4 ± 0.5	8.47 ± 2.4	0.001

#### 4. DISCUSSION

Benign thyroid tumors compressing trachea is a rare disease in developed countries because patients are periodically examined and treated early. However, in Vietnam, due to low economic conditions, patients do not care about treating goiter. The patients are only hospitalized when the goiter causes symptoms such as difficulty of breathing or choking. The main symptoms are dysphagia accounting for 21.6% and difficulty of breathing when lying down was 16.7%. The average narrow tracheal diameter was 8.4 mm and 12.7% patients had a tracheal diameter below than 5 mm. Findlay [3] reported 62 patients with tracheal stenosis below than 15 mm performed CT and the proportion of tracheal diameter below 5 mm was 29%, the mean tracheal diameter was 7.6 mm. Mean length of stay in tracheal diameter < 5 mm group was shorter than the other.

Large goiter compresses the surrounding organs, changes the anatomical structure. Complications when removing benign goiter compressing trachea following complications are more likely to occur in Benign goiter compressing trachea than normal Thyroidectomy surgery: hoarseness 6.9%, hand numbness by hypocalcemia 15.7%. According to Erbil et al. [9], 7% of patients suffered temporary hypoparathyroidism. In another study, Pieracci [10] reported the complication after goiter surgery: recurrent laryngeal nerve injury (OR = 2.4, 95% CI [1.5–3.8]), postoperative bleeding (OR = 1.9, 95% CI [1.2–2.9]), deep vein thrombosis (OR = 5.9, 95% CI [2.4–15.2]), respiratory failure (OR = 4.2, 95% CI [2.8–6.2]). Thus, surgeons need to pay attention to important components such as recurrent laryngeal nerves and parathyroid glands.

Chronic compression of the trachea can cause the atrophy of the cartilage of trachea. This leads to tracheomalacia, which is noted more by surgeons recently. 2 of 5 cases had the soft tracheal compression area and were repaired by tracheopexy. 2 of 5 the rest cases, we keep the endotracheal tube in the postoperative time. The last case failed with removing the endotracheal tube and then was reintubated. Tracheomalacia appeared in 5.3% in 507 patients with goiter performed thyroidectomy of Ayandipo's study [2]. He also reported 3 of 507 patients died, among them, there were 2 cases with tracheomalacia.

It is noted that the correlation is statistically significant between tracheomalacia and non-tracheomalacia; the elderly ( $p=0.041$ ); duration of goiter ( $p=0.07$ ); difficulty breathing when

lying down ( $p=0.003$ ); narrow trachea ( $p=0.001$ ). We also recognized that the weight of goiter causing tracheomalacia was huge ranged from 477 to 706 grams. Nakadate et al. reported that risk factors for the development of serious postoperative tracheomalacia included a long-standing goiter of more than 5 years preoperative recurrent laryngeal nerve palsy, significant tracheal narrowing and/or deviation, retrosternal extension, difficult endotracheal intubation, and thyroid cancer [11]. On the other hand, Wen T. Shen [12] showed patients with airway postoperative complications were older than 70.3 years, or had larger goiters > 200 grams, or had severe narrow trachea. The small number of tracheomalacia is the limitation of this study, but they also show some interesting things.

#### 4. CONCLUSION

Tracheomalacia needs to be detected and treated in the early period to avoid the severe postoperative complication. Tracheomalacia should be noted in patients older than 65 years old, goiter exists longer than 5 years and goiter is over 200 gram and tracheal diameter <5mm may related to tracheomalacia.

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