HUGE MULTINODULAR GOITER WITH MID TRACHEA OBSTRUCTION: INDICATION FOR FIBEROPTIC INTUBATION

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SUMMARY – Goiter or thyromegaly is one of the most common causes of mid tracheal obstruction (external compression or stenosis), which may be associated with difficult larynx visualization and/or difficult airway management, depending on the goiter size, type and ingrowth into the surrounding tissue. Iodine deficiency disorders are still one of the most common causes of goiter in the population of the African continent. These patients with goiter generally present for medical examination at an advanced stage of the disease. Mallampati test, thyromental distance and inter-incisor gap appear to provide the optimal combination for prediction of difficult visualization of the larynx. Video laryngoscopy examination of the subglottic region and inspection of tracheal deviation in the presence of tracheal compression without detected stenosis of the trachea is a standard and preferred technique in comparison with direct laryngoscopy. Intubation can be performed when vocal cords are visualized. The major difficulty on intubation is encountered in only 5.3% of patients with goiter. Large goiter need not always be associated with a higher incidence of difficult endotracheal intubation. Only two predicting factors for difficult airway assessment were identified in these patients: cancerous goiter (especially if compressive signs are present) and Cormack and Lehane grade III/IV. The indication for fiberoptic intubation is tracheal compression or initial tracheal stenosis. Conventional tracheostomy has to be performed in goiter patients with identified tracheomalacia and/or high degree or tracheal stenosis.

Key words: *Multinodular goiter; Mid tracheal obstruction; Airway management; Fiberoptic intubation*

Introduction

Goiter (thyromegaly, struma) is one of the most common causes of mid tracheal obstruction including other retrosternal processes, chest tumors, etc. Secondary, it causes swelling and deformity of the larynx and neck[1]. Endemic goiter in Africa (Zaire, South Africa, Uganda, Sudan, Ethiopia, Tanzania) is mostly caused by iodine (>90%) and selenium deficiency or goitrogens (<10%). Goitrogens are naturally-occurring, inhibitory substances of thyroid gland function, found in daily staple food (e.g., thiocyanate, an ingredient of detoxified cassava/manioc/yucca)[2,3]. Goiter can be associated with normal thyroid gland function or hormonal dysfunction (hypo- or hyperthyroidism). The myxedematous or neurological form (1%-10%) is present in the areas of severe iodine deficiency[4]. Autoimmune disease (Grave's disease with thyrotoxicosis) (1%-10%), iatrogenic factors (amiodarone with subclinical hypothyroidism) (27%) and

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Received July 6, 2012, accepted August 23, 2012

Table 1. Guide to airway obstruction

TYPE OF OBSTRUCTION	Upper airway	Mid trachea	Lower airway
LEVEL	Oropharynx Larynx, voice box Upper part of trachea	Trachea	Lower trachea and bronchi
Acute	Immediate blockage of the airway with acute respiratory failure		
Chronic	Airway blockade during the time		
BACKGROUND	Trauma, tumor, infection	Retrosternal processes, chest diseases	Large mediastinal masses, lung cancer
CAUSES	Edema (allergic reactions, chemical and fireburns), inflammation (viral or bacterial infections, croup, epiglottitis, peritonsillar and retropharyngeal abscesses) Foreign bodies, developed tumors (throat, tongue, vocal cord cancer), trauma, tracheomalacia	Goirte, foreign body, tumor, abscess, blood clot, enlargement of a nearby structure (esophagus), blunt trauma (motor vehicle accident or fall), aspiration, strictures, endotracheal intubation, temporary tracheostomy, scar tissue reaction to parasites	Pulmonary secretions, aspiration, foreign body, bronchial tumors and carcinoma, metastatic tumor, enlarged lymph nodes, tracheal and bronchial stenosis, infection, bronchial edema, enlarged pulmonary veins and atrium

thyroid cancers (follicular:papillary = 35:27%) are mostly reasons for thyroid dysfunction in the endemic Africa region[5-7].

Difficult access to airway caused by external (compression) and/or internal obstruction depends on the level and causes of the obstruction at the time of obstruction development (acute or chronic) (Table 1).

The specificity of the airway approach in patients with goiter depends on its size and vascular pattern. According to the World Health Organization (WHO) classification of the goiter growth size, only class II (very large, retrosternal goiter) results in compression of the surrounding tissue structures and trachea pushing outside the central axis (class 0 = goiter is within the structures of the neck, not visible but palpable; and class I = it is visible and palpable, undermines the curves and the neckline)[8]. Plunging goiter is a thyroid tumor whose lower half is not palpable in surgical position. It can be found in 63% of goiters as cervical descended, mediastinal or thoracic developing goiter. It is most frequently prevascular, at the level of the superior vena cava (9.7%), left brachial-cephalic venous trunk (39%) or aortic arch (36.5%)[9]. Cervico-sternotomy followed by cervico-thoracic approach is needed in about 5% and thoracotomy in 1% of these cases[10].

Prevention modalities, pharmacological treatments and surgical approach are not available in all parts of the African continent. There are neither teams nor timely available medical service. Most of the patients with goiter present for medical examination only at an advanced stage of disease when difficult airway management is usually present.

Huge multinodular goiter (class II, weight >400 g) is usually responsible for tracheal deviation with or without mid trachea compression or narrowing, which indicates the presence of difficult airway access. In this case, awake fiberoptic intubation is a preferred technique in comparison with video laryngoscopy intubation because the former allows complete visualization of the entire airway with correct tracheal intubation performance. Conventional, elective tracheostomy is indicated preoperatively in the presence of advanced tracheal stenosis. On the other hand, potential tracheomalacia due to long-standing tracheal compression by the large goiter mass can be the reason for respiratory failure after thyroidectomy because of tracheal collapse. Postoperative tracheostomy is indicated immediately in these cases.

The aim of our presentation is to highlight the importance of fiberoptic intubation in huge class II goiters where tracheostomy is not indicated.

Case Reports

The basic descriptive parameters of our two goiter patients included:

- morphological characteristics of thyromegaly (multinodular/diffuse, euthyroid/hormonal dysfunction by clinical symptoms and biochemical tests), etiology background (immune, specificity of intake disturbance) with pathogenesis (benign/malignant);
- presence of clinical symptoms (hoarseness, dysphagia, changes in voice quality, dyspnea);
- patient demographic characteristics: ASA status I, II or III; sex female/male; age (years); body mass index (BMI) = weight (kg)/height (m^2); and
- ruling out acute infections (malaria, hemorrhagic fever, hepatitis, AIDS) and anatomical deformity of the neck and head caused by other tumors and diseases (noma).

Evaluation of their difficult endotracheal intubation included:

- scoring scales for difficult airway management: Mallampati (modified by Samsoon and Young)[11], and Cormack and Lehane classification[12], thyromental, sternomental[13] and inter-incisor distances followed by degree of neck extension[14];
- clinical classification of goiter (WHO clinical classification of the goiter growth size: class 0, I or II) and its extensiveness (size: measured before surgery, in maximal possible neck extension, over the most prominent line in centimeters; weight: measured after extirpation at the end of the surgery in grams);
- evaluation of the subglottic area in local anesthesia by indirect laryngoscopy; and
- preoperative computed tomography (CT) of the neck and chest: the presence of anatomical deformity excluded; tracheal deviation verified (tracheal shift to 1 cm beyond the midline), stenosis (tracheal narrowing >30%), and/or presence of tracheal erosion as a sign of tracheomalacia.

Fiberoptic intubation was indicated after patient clinical and diagnostic assessment of tracheal intubation difficulty in the absence of the signs of tracheomalacia on CT scan (Table 2, Figs. 1 a, b and 2 a, b).

Table 2. Airway assessment with goiter characteristics in two study patients (patient A and patient B)

		Patient A		Patient B
Patient description	Age (yrs)	43		55
	Gender	Female		Male
	BMI kg/m^2	26.4		27.2
Goiter characteristics	Clinical symptoms	Hoarseness		NO
	Hormonal activity		Ezthyreotic	
	Morphology		Multinodular	
	Etiology		Iodine deficiency	
	Pathogenesis		Benign	
	WHO class		II	
	Weight (g)	435		667
	Neck range (cm)	53		62
CT	Mild tracheal compression	YES		NO
	Tracheal deviation	NO		YES
	tracheomalacia	NO		NO
Airway assessment	Mallampati score	II		II
	Cormack and Lehane class	III		II
	Thyro-mental distance		Unreliable	
	Sterno-mental distance		Unreliable	
	Inter-incisor distances	4		
	Neck extension grades		>30	

Fig. 1. Patient A: female, 43 years: multinodular euthyroid goiter (class II, 435 g) with hoarseness preoperatively and mild trachea wall compression (CT); (a) lateral, and (b) anterior view of the patient's neck (the image is published with the approval and consent of the Ethics Commission Africa Mercy Ship 903.939.7134).

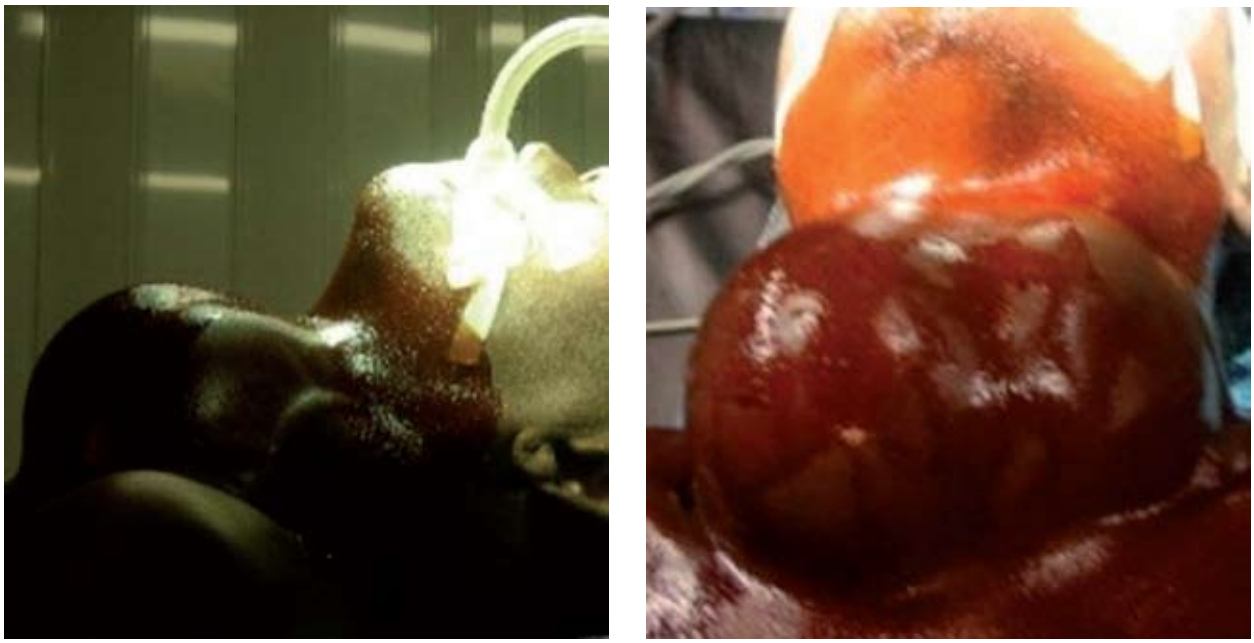

Fig. 2. Patient B: male, 55 years: giant multinodular euthyroid goiter (class II; 667 g) without preoperative symptoms but left side tracheal wall distraction (CT); (a) lateral, and (b) anterior view of the patient's neck (the image is published with the approval and consent of the Ethics Commission Africa Mercy Ship 903.939.7134).

Awake fiberoptic tracheal intubation was performed after explaining the necessity of the procedure to the patients and obtaining an informed consent from them. The procedure was performed according to the general standards for awake fiberoptic intubation.

Discussion

The incidence of difficult tracheal intubation is between 3% and 18% during routine anesthesia[15]. In elective patients with thyromegaly undergoing thyroid surgery, Bouaggad *et al.* found moderate to major difficulty of intubation in only 5.3% of patients[16]. Minor intubation difficulty was encountered in most patients from the same study (57.8%), while easy tracheal intubation was recorded in 36.9% of patients. In this study, large goiter was not associated with a higher incidence of difficult endotracheal intubation. There were only two predicting factors for difficult airway assessment: cancerous goiter (especially if compressive signs are present) and Cormack and Lehane grade III/IV[17]. Male patients with higher body mass index, Mallampati class III/IV, small thyromental distance (<6 cm) and neck mobility less than 10 grades were associated with a potential risk of difficult endotracheal intubation. In comparison with our two case reports, patient B with giant goiter supported these findings. Left deviated trachea in this patient did not aggravate placement of the endotracheal tube after fiberoptic vocal cord visualization. In patient A with mild tracheal compression, endotracheal tube (by half of size smaller than expected) was placed by fiberoptic intubation through the compressed portion of the trachea without resistance.

Mc Henry *et al.* noted that the presence of tracheal compression and/or stenosis in goiter patients may be an aggravating factor for difficult endotracheal intubation, making an indication for fiberoptic intubation. Tracheal stenosis caused by fibrosis or infiltration processes, which significantly reduces tracheal passage and mobility of laryngeal structures, usually from the start disables laryngoscope view as a possibility of fiberoptic endotracheal intubation. In these patients, conventional tracheostomy is indicated before thyroidectomy[15].

Merah *et al.* report on difficult visualization of the larynx in 3.4% of goiter patients. According to this study, the most successful predictors are Mallampati test (85%), inter-incisor gap (95%) and thyromental distance (36%)[17]. In the presence of tracheal compression without detected stenosis of the trachea, tracheal deviation can then be examined by video laryngoscopy technique. Intubation can be performed when vocal cords are visualized[18].

Fiberoptic intubation is always indicated in goiters when tracheal deviation and clinical symptoms of tracheal compression and/or stenosis are present[19-21].

Conclusions

Euthyroid multinodular thyromegaly or giant goiter causes difficult visualization of the larynx and/or difficult endotracheal intubation in 5.4% of the population of the Africa continent. In these patients, airway preservation correlates with the procedure specific morbidity and mortality.

In the absence of clinical symptoms of tracheal stenosis and goiter mediastinal progression, fiberoptic endotracheal intubation is indicated.

Video laryngoscopy is useful for exploring the supra- and infra-glottic regions in these patients and deviated trachea in cases where difficult visualization of the larynx is present.

Acknowledgments

Thanks are due to all members of the international humanitarian surgical team and staff of the Mercy Ship Africa, who have contributed to the final drafting of the article directly or indirectly through their work (http://www.mercyships.org/content/home).

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Sažetak

VELIKA MULTINODULARNA STRUMA S KOMPRESIJOM TRAHEJE: INDIKACIJA ZA FIBEROPTIČKU INTUBACIJU

D. Bartolek i *A. Frick*

Multinodularna eutiroidna tiromegalija jedan je od najčešćih uzroka kompresije traheje i otežanoga pristupa dišnome putu. U 90% slučajeva etiološki je vezana uz nedostatan peroralni unos joda i/ili selena, a jednim dijelom i tireostatskim učinkom tvari poput tiocijanata. Tipične kliničke slike uznapredovale gušavosti susreću se i u endemskim područjima afričkog kontinenta (Zair, Južnoafrička Republika, Uganda, Sudan, Etiopija, Tanzanija, Nigerija). Većina ovih bolesnika dolazi s uznapredovalom bolešću kada je uslijed proširenosti strume već otežana vizualizacija larinksa i/ili teško dostupan dišni put. Pojedini bolesnici mogu izražavati simptome stenoze (kompresije) traheje uz disfagiju, promuklost i različit stupanj respiracijske insuficijencije, osobito uz medijastinalni prodor uvećane žlijezde. Specifičnost endotrahealne intubacije tada podliježe visokom proceduralnom pobolu i smrtnosti. Neovisno o veličini strume incidencija otežanog pristupa dišnome putu kod ovih bolesnika je 5,3%. Prediktorni testovi (Mallampati, Cormack-Lehane, tiromentalna udaljenost, pokretljivost vrata i sl.) uz prepoznavanje kliničkih simptoma doprinose optimalnom odabiru tehnike endotrahealne intubacije. Standardno pravilo uključuje video-laringoskopsku eksploraciju supra- i infraglotične regije te fiberoptičku endotrahealnu intubaciju otežanog dišnog puta.

Ključne riječi: *Multinodularna struma; Stenoza traheje; Zbrinjavanje dišnog puta; Fiberoptička intubacija*