

Benign Nodular Goiter Causing Upper Airway Obstruction

Üst Solunum Yolu Tıkanıklığına Yol Açan Benign Noduler Guatr

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Abstract

Objective. Benign nodular goiter (BNG) can cause narrowing of the upper airway. In some rare cases, obstruction of the upper airway also occurs. The following paper reports our experiences with regard to BNG patients who experienced obstruction of the upper airway.

Materials and Methods. We retrospectively investigated the records of 13 patients with acute airway obstruction due to BNG who were admitted to the General Surgery Department of Ataturk University Medical School between January 2000 and December 2007.

Results. Thirteen patients with airway obstruction secondary to BNG were hospitalized during this period. There were two males and 11 females, and the mean age was 58.5 years (range 37-74 years). For all patients, the primary symptom upon admission was defined as respiratory distress; all patients had varying degrees of respiratory distress upon admission. Three of the patients underwent emergent endotracheal intubation in the emergency room.

A preoperative radiological evaluation was performed with thyroid ultrasonography (US) and computed tomography (CT). There were retrosternal or substernal components of the BNG in nine patients. Twelve patients underwent operations, while one patient with mild respiratory distress elected not to be operated on. Ten patients underwent total thyroidectomies, while two patients underwent near-total thyroidectomies. One patient with retrosternal goiter also underwent a median sternotomy. Three patients received a tracheostomy after the operation.

Suction drains were utilized in all operations. During the post-operative period, two patients suffered from voice impairment, and seven patients experienced hypocalcemia. Two patients died. Pathological examination of the thyroidectomy tissue revealed BNG in all cases. In addition, two patients had micropapillary carcinomas.

Conclusion. Although BNG causing upper airway obstruction is rare, it is an important clinical entity because of the need for emergent operation, the increased rate of complications, and high mortality.

Keywords: Nodular goiter, Upper airway, Obstruction

Özet

Amaç. Nodular guatr (NG) üst solunum yolunun daralmasına neden olabilir. Nadir olgularda, üst solunum yolunda tam tıkanma oluşur. Bu makalede NG'ye bağlı üst solunum yolu tıkanması görülen hastalarımızdaki tecrübelerimizi aktardık.

Gereç ve Yöntem. Ataturk Üniversitesi Tıp Fakültesi Genel Cerrahi Anabil Dalı'na Ocak 2000-Aralık 2007 tarihleri arasında BNG'ye bağlı üst solunum yolu tıkanması nedeniyle müracaat eden 13 hastanın kayıtlarını retrospektif olarak inceledik. Kayıtlar, yaş, cinsiyet, başvuru anındaki semptomlar, önceki tıbbi öykü, fizik muayene bulguları, solunum sıkıntısının derecesi ve şiddeti, radyolojik ve laboratuvar bulgular, ameliyet bulguları, postoperatif seyir ve komplikasyonlar yönüyle incelendi.

Bulgular. Belirtilen sürede BNG'ye bağlı solunum sıkıntısı nedeniyle 13 hasta hastaneye kabul edildi. Hastaların ikisi erkek, 13'ü bayan ve ortalama yaş 58.5 idi (37-74 yaş). Tüm hastalarda başvuru nedeni semptom solunum sıkıntısıydı. Tüm hastalar tiroidektomi adayları idiler ancak, 12 hasta ameliyatı reddetmiş bir hasta ise ameliyat ön hazırlığı olarak anti-tiroid ilaçlar almaktaydı.

Tüm hastalarda başvuruda değişik derecelerde solunum sıkıntısı vardı. Üç hastaya acil serviste acil endotrakeal entübasyon uygulandı. Dört hastada eşlik eden kronik obstrüktif akciğer hastalığı, 4 hastada konjestif kalp yetmezliği, 2 hastada diabetes mellitus, bir hastada serebro vasküler olay mevcuttu ve bir hasta daha önceden apendektomi geçirmişti.

Ameliyat öncesi radyolojik değerlendirmede tiroit ultrasonografisi (US) ve bilgisayarlı tomografi (BT) kullanıldı. Dokuz hastada BNG ile ilgili olarak retrosternal veya substernal komponent yoktu. Hastalardan 12'si ameliyat edildi ancak orta düzeyde solunum sıkıntısı olan bir hasta ameliyat olmayı reddetti. On hastada total, 2 hastada subtotal tiroidektomi yapıldı. Retrosternal guatrı olan bir hastada median sternotomi uygulandı. Üç hastada ameliyattan sonra trakeostomi uygulandı.

Tüm ameliyatlarda emici drenler yerleştirildi. Ameliyattan sonra iki hastada ses kısıklığı 7 hastada ise hipokalsemi görüldü. İki hasta kaybedildi. Çıkarılan cerrahi materyalin incelenmesinde tüm hastalarda BNG ve iki hastada ek olarak mikropapiller kansere rastlandı.

Sonuç. Her ne kadar BNG'ye bağlı üst solunum yolu tıkanması nadir olsa da, acil ameliyatlara gerektirmesi, komplikasyonların ve mortalitenin yüksek olmasından dolayı önemli bir klinik antitedir.

Anahtar Kelimeler: Nodular guatr, Üst solunum yolu, Tıkanıklık

Introduction

Benign enlargement of the thyroid gland, or goiter, affects up to 15% of the population in endemic areas. The symptoms of goiter are mostly due to the enlargement of the gland. The location of the gland makes this enlargement important because it can compress the trachea. Acute compression of the airway and dyspnea are mostly secondary to rapid enlargement of the thyroid mass. The following are cases of patients with acute airway obstruction secondary to benign nodular goiters (BNG) [1].

Materials and Methods

We retrospectively investigated the records of 13 patients with acute airway obstruction due to BNG admitted to the General Surgery Department of Ataturk University Medical School between January 2000 and December 2007. The records were investigated to determine the age and sex of the patients, symptoms on admission, duration of the symptoms, previous medical history, physical examination findings, degree and severity of respiratory distress, radiological and laboratory findings, operative findings and postoperative course, and complications.

Results

Thirteen patients with airway obstruction secondary to BNG were hospitalized during this period. There were two males and 11 females, and the mean age was 58.5 years (range 37-74 years). In all patients, the admission symptom was respiratory distress that had lasted for a period of 3.2 days on average. All patients had been diagnosed with BNG prior to the time of admission. The time of the diagnosis varied between two months and 23 years before admittance (mean ten years). All were candidates for a thyroidectomy, but 12 had denied operations and only one was receiving anti-thyroid drugs in preparation for the operation. The results are summarized in Table 1.

All patients had varying degrees of respiratory distress upon admission. Three of the patients underwent emergent endotracheal intubation in the emergency room. Seven patients suffered from moderate respiratory distress and three suffered from mild respiratory distress. None of the patients had symptoms consistent with hyperthyroidism.

Apart from the BNG diagnosis, four patients had co-existing chronic obstructive pulmonary disease, four had congestive heart failure (two with atrial fibrillation), two had diabetes mellitus, one patient had suffered from a cerebrovascular accident, and one had undergone an appendectomy. All patients had previously received anti-thyroid drugs and only two of them were taking the medication regularly. None of the patients were previously operated on for thyroid disease.

All patients had a cervical mass consistent with an enlarged

thyroid gland. Preoperative radiological evaluation was made with thyroid ultrasonography (US) and computed tomography (CT). US revealed thyroid gland enlargement in all patients, and three patients had enlarged cervical lymph nodes (two sternocleidomastoids and one jugular). CT showed enlarged thyroid glands and compression of the trachea in all patients. There were also retrosternal or substernal components of BNG in nine patients.

Preoperative thyroid function tests, including free T3 (FT3), free T4 (FT4), and thyroid stimulating hormone (TSH) were done in all patients. Only one patient had low serum TSH levels (0.01 ng/ml) and no signs of hyperthyroidism. This patient's FT3 and FT4 levels were in the normal range (subclinical hyperthyroidism). The remaining 12 patients had normal FT3, FT4 and TSH levels.

Surgery was performed on twelve patients. One patient with mild respiratory distress declined surgery and left the hospital. This patient was admitted to the emergency room one week after he left the hospital and died in the ER due to upper airway obstruction and cardio-pulmonary insufficiency.

All operations were performed under emergent circumstances (Figures 1,2). Ten patients underwent total thyroidectomies and two underwent near-total thyroidectomies. One patient with a retrosternal goiter also underwent a median sternotomy. No radical cervical lymph node dissections were performed. Three patients received a tracheostomy after the operation because of prolonged endotracheal intubation (the tracheostomy was performed five days after the initial operation on one patient) and tracheomalacia (two patients received a tracheostomy just after the operation). The first tracheostomy patient died due to pulmonary insufficiency, and the two tracheomalacia patients were discharged from the hospital; tracheostomy closure in these patients was performed at one month post-operatively. The remaining nine patients were successfully extubated either immediately after the operation or a few hours later. Suction drains were utilized in all operations. Drains were removed when the amount of drainage decreased to less than 20 cc daily. During the post-



Fig. 1 — Preoperative view of a young patient with tracheal obstruction due to enlarged cervical mass.

operative period, two patients suffered from voice impairment and seven suffered from hypocalcemia. Voice impairment was transient in all patients and managed with an anti-edema treatment (cortisone 0.5-1 mg/kg/day). Voice impairment recovered in 20 days in one case and in two months in the other one. Hypocalcemia was managed with a calcium infusion and active vitamin D, according to the severity of clinical findings. The mean hospitalization time was 10.5 days (range 5-25 days). One patient who refused treatment and left the hospital was later readmitted and died in the ER due to upper airway obstruction and cardio-pulmonary insufficiency. The other patient died due to pulmonary insufficiency.

Pathological examination of the thyroidectomy tissues revealed BNG in all. In addition, two patients had micropapillary carcinomas.

Median follow-up time was 44 months (range 6-61 months). There were no recurrences of the nodular goiters in patients with micropapillary cancers.

Discussion

Upper airway obstruction due to an enlarged thyroid gland that needs prompt intervention is a rare condition. The incidence of BNG causing upper airway obstruction is not well defined, and reportedly varies between 0.8 and 31% in different studies [2,3]. Abraham et al. [1] report the incidence of upper airway obstruction requiring emergent airway intervention as 0.6%. Saha et al. [4] report that acute dyspnea can develop in 25% of patients with intrathoracic goiters, and that 18% of them may require endotracheal intubation. A total of 993 BNG patients were operated on in our clinic during the same period (between January 2000 and December 2007), and based on this data the incidence of BNG causing upper airway obstruction and requiring emergent airway intervention is 1.3%.

Several reasons have been suggested for the acute obstruction of the upper airway in BNG. It is said that retrosternal localization of the enlarged gland is mostly associated with tracheal compression and displacement, thus causing varying degrees of dyspnea. It is also reported that recognizable changes in lung function occur when the cross-sectional area of the airway has been reduced by more than 50% [2].

Abraham et al. [1] report that most of their five cases had retrosternal goiters. In our series, retrosternal thyroid enlargement was seen in three patients, but another six patients had a substernal component of the enlarged cervical thyroid mass. The fact that the retrosternal space is relatively small and doesn't allow the thyroid gland to enlarge contributes to the obstruction in patients with retrosternal or substernal goiters. Compression and distortion of the airway by the enlarged gland in retrosternal BNG, however, is not an acute event. Retrosternal BNG predisposes, but does not cause, obstruction. The exact cause of obstruction in a BNG patient who already has a compressed airway is not clear. Reasons that might have contributed to this acute event include upper respiratory tract infections, chronic obstructive pulmonary disease (COPD), and bleeding into a cystic component of the enlarged gland [5-7]. None of our patients



Fig. 2 — Obstructing large thyroid mass excised from the same patient.

had upper respiratory tract infections. Some, however, had COPD and/or cardiac insufficiency.

It is reported that thyroid patients with advanced age are more likely to be candidates for a thyroidectomy because of an obstructing thyroid mass [8-10]. There was only one patient with an exception to this trend in our series. The others were mostly between 57 and 60 years old. It is also interesting to note that 11 patients were close to being between 57 and 60 years old. This finding, of course, is not of clinical importance, but what is important is that they were patients of moderately advanced age.

In fact, despite these contributing factors, we think that the main reason for the acute presentation is the time delay between diagnosis and operation. Only one patient with retrosternal goiter presented with upper airway obstruction during the medical preparation period for the operation. The other patients refused the operation. During waiting times before the operation, the thyroid gland enlarges and the trachea becomes compressed and distorted, which causes both anatomical distortion and functional impairment. It is reported that giant goiters cause significant impairment of the upper airway dynamics [1,3,11-13]. This impairment can easily develop into upper airway obstruction when the factors presented above are considered.

The narrowing of the upper airway can either be symptomatic (present with dyspnea) or asymptomatic [12]. It is reported that up to 25-33% of patients with giant goiters have upper airway obstruction symptoms, and 10% of these patients require emergency airway intubation. It is also reported that the symptoms are usually not due to the size of the gland, but rather to the compression of vital structures at the level of the bony thoracic inlet [4]. All of our patients had an enlarged thyroid gland that could be described as a giant goiter and nine of them also had retrosternal goiters or cervical goiters with a substernal component. None of them, however, had respiratory distress related to dyspnea before the acute onset of the symptoms of upper airway obstruction. Three of our patients required urgent endotracheal intubation.

Table 1. Detailed data of the patients.

Age	Gender	Dyspnea	Symptom duration	Urgent intubation	Previous anti-thyroid medication	Co-existing diseases	Features of thyroid mass	Operation	Postoperative complications	Hospital stay	Mortality
57	M	Severe	12 hours	+	Non-ordinarily	COPD CHF	Retrosternal	Denied to be operated	-	5 days	Airway obstruction, cardio-pulmonary insufficiency
37	F	Mild	3 days	-	Ordinarily	Appendectomy	Cervical, Substernal	Total thyroidectomy	Hypocalcemia Voice impairment	5 days	-
58	F	Moderate	2 days	-	Non-ordinarily	CHF AF DM	Cervical, Substernal, Cervical LAP	Total thyroidectomy	Tracheomalacia Tracheostomy	7 days	-
59	F	Mild	4 days	-	Non-ordinarily	COPD	Cervical, Substernal, Cervical LN	Total thyroidectomy	Prolonged intubation, Tracheostomy	21 days	Pulmonary insufficiency
59	F	Moderate	3 days	-	Non-ordinarily	CVA	Cervical, Substernal, Cervical LN	Total thyroidectomy	Hypocalcemia Voice impairment	12 days	-
60	M	Mild	6 days	-	Ordinarily	DM	Cervical	Near-total thyroidectomy	Hypocalcemia	11 days	-
60	F	Severe	12 hours	+	Non-ordinarily	-	Retrosternal	Total Thyroidectomy, Sternotomy	Hypocalcemia	7 days	-
60	F	Moderate	4 days	-	Non-ordinarily	COPD	Cervical, Substernal	Total thyroidectomy	-	3 days	-
60	F	Moderate	2 days	-	Non-ordinarily	-	Retrosternal	Total thyroidectomy	-	6 days	-
57	F	Severe	12 hours	+	Non-ordinarily	CHF AF	Cervical	Total thyroidectomy	Tracheomalacia, Tracheostomy	16 days	-
59	F	Moderate	1 day	-	Non-ordinarily	-	Cervical, Substernal	Total thyroidectomy	Hypocalcemia	7 days	-
60	F	Moderate	3 days	-	Non-ordinarily	-	Cervical, Substernal	Total thyroidectomy	Hypocalcemia	6 days	-
74	F	Moderate	4 days	-	Non-ordinarily	COPD CHF	Cervical	Near-total thyroidectomy	Hypocalcemia	25 days	-

COPD: Chronic obstructive pulmonary disease, CHF: Congestive heart failure, DM: Diabetes mellitus, AF: Atrial fibrillation, CVA: Cerebrovascular accident, LAP: Lymphadenopathy

Diagnosis of this entity is not difficult. Other conditions causing acute dyspnea and upper airway obstruction must be considered in such patients. It is reported that standard posterior-anterior and lateral chest X-rays are considered the single most valuable diagnostic tools with regard to the study of intrathoracic goiters as these radiographs can provide valuable information about the compression of the trachea [14]. In emergent circumstances, however, a further assessment with US or CT is necessary given the severity of airway obstruction. CT and US were found to be of equal benefit with regard to diagnosis. US is more sensitive in detecting small nodules that cannot be shown by CT, while CT is superior with regard to defining intrathoracic extension of the enlarged thyroid gland [14]. Therefore, we used CT in all of our patients. In contrast to US, CT more clearly demonstrated the tracheal obstruction and retrosternal component. CT also provides more information for the differential diagnosis of mediastinal masses that can also cause upper airway obstruction, such as bronchial carcinoma, thymomas, dermoid cysts, or lymphomas [15].

The differential diagnosis for dyspnea is important. Nandwani et al. [16] report a case in which upper airway obstruction and dyspnea were confused with asthma. They used a flow-volume loop, as this test serves to aid in the diagnosis and monitoring of suspected airway obstruction. Similar findings reported by Thusoo et al. [12] support the idea that flow-volume loops provide an added advantage over conventional radiology alone in the detection of upper airway obstruction. The use of this test in our cases was not an option as the upper airway obstruction in our patients needed to be managed urgently.

Preoperative assessment of thyroid hormones is another important issue. The hormone profile was consistent with sub-

clinical hyperthyroidism in only one of our patients. Whatever the thyroid hormone levels are, the emergency setting means that patients require immediate operation.

Surgical treatment is indicated for the treatment of BNG causing upper airway obstruction. In cases where surgery is contraindicated and in the case of refusal of surgery, Noppen et al. [7] recommend the use of interventional bronchoscopic procedures and stent insertion. We performed total thyroidectomies in ten cases and near-total thyroidectomies in two cases. The surgical procedure is the same in emergent cases as in elective cases. The most important aspect lies in decompressing the upper airway. We observed that patients were not dyspneic after the operation when the trachea was normal (i.e., when tracheomalacia was not present). It is reported that compression symptoms secondary to enlargement of the thyroid mass regress after the removal of the gland [12].

It has been stated that nearly all intrathoracic goiters can be removed from the cervical incision safely, and that sternotomy is required in only rare cases [15,17]. In cases with previous thyroid operation, large masses, suspected malignancies, totally intrathoracic lesions, and signs of vascular compression, access into the thoracic cavity was made available by an anterior or high posterolateral thoracotomy or median sternotomy. We were able to perform the thyroidectomies via the cervical incision in all patients, with the exception of one. In this case, we used a median sternotomy. Some authors suggest the use of cervical incisions coupled with suction techniques in all cases [15,17]. The use of these aspiration techniques, however, is not suggested.

In our series, complications after the surgical intervention for BNG causing upper airway obstruction were tracheomalacia, voice impairment, and hypocalcemia. Tracheomalacia is not

common, and the reported incidence varies between 0.001% and 1.9% in various series [18]. Tracheomalacia is a result of the pressure exerted by the mass upon the trachea, causing necrosis in some parts of the tracheal wall and leading to the complete collapse of the airway by muscle relaxation [19]. The relatively high incidence of tracheomalacia in our patient population could be attributed to the excessive compression of the trachea. It is suggested that tracheostomies are the best way to manage this complication, and should be performed intraoperatively if the trachea is soft and floppy or collapses following the gradual withdrawal of the endotracheal tube [18]. In our two patients, tracheomalacia was managed with successful tracheostomies.

The rate of transient and permanent hypocalcemia in the reported series was between 21-26% and 1.9-3.6%, respectively [8]. These reported rates are for elective surgical operations. The rate in our series was 53% for transient hypocalcemia, yet there was no permanent hypocalcemia. We attributed this high transient rate to the large thyroid mass and to the emergent operative setting. The rate of voice impairment was 15.3% in our series. We believe that similar reasons that explain the high rate

of transient hypocalcemia are responsible for voice impairment.

Median hospitalization time was 10.5 days. The reported hospitalization time is between 4.7 and 11 days in the literature. Abraham et al. [1] report that the median hospitalization time was 28 days in their series. They also report that the median intensive care unit stay was 14 days. We attribute the shorter hospital stay in our series to the relatively low number of co-existing diseases and the fact that stays in the intensive care unit were not needed.

BNG causing upper airway obstruction is important because it requires emergent thyroidectomy. Most of these cases have an intrathoracic or extended thyroid gland enlargement. Surgical treatment is inevitable, but decompression is effective for resolving the symptoms. It is known that in emergent operations, especially in patients with advanced age, postoperative morbidity and mortality increases [8]. In fact, thyroidectomies under elective circumstances have very low mortality rates and an acceptable morbidity rate. Emergent circumstances, however, increase not only the mortality associated with co-existing diseases but also the rate of postoperative complications.

Conflict interest statement The authors declare that they have no conflict of interest to the publication of this article.

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