Buckled Thyroid Cartilage: An Anatomic Variant

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Summary: Objective. Anatomic abnormalities in the larynx can cause significant and bothersome symptoms. Identified here is an anatomical variant of the thyroid cartilage.

Study Design. This study is a retrospective case series of 11 subjects diagnosed with an anatomic variant of the thyroid cartilage.

Methods. Patients with an anatomic inward buckling of the thyroid cartilage, termed here as buckled thyroid cartilage, were identified through a 20-year retrospective chart review of a tertiary care laryngology practice.

Results. We describe 11 patients with fullness or asymmetry in the area of the false vocal fold and an associated inward buckling of the thyroid cartilage on computed tomography scan. All patients presented with a bothersome voice-related complaint. The most common presenting complaints were hoarseness (54%), globus sensation (45%), or vocal fatigue (27%). One patient was found to have a history of known laryngeal trauma. Surgical correction through an external approach on one patient was successfully performed with subsequent resolution of symptoms.

Conclusion. We postulate that deformity and protrusion of the false vocal fold can result in a dampening effect on the vibratory capacity of the vocal fold that can lead to symptomatic hoarseness and vocal fatigue. Buckled thyroid cartilage is, therefore, an important anatomical variant to be aware of and be able to recognize.

Key Words: Thyroid cartilage–Deformity–Anatomical variant–Larynx–Anatomy.

INTRODUCTION

The laryngeal framework is derived from the pharyngeal arches and serves to support complex functions of the aerodigestive tract including swallowing, phonation, and respiration. An understanding of the anatomy and function of each component is important when assessing and diagnosing laryngeal pathology.

Authors have examined the laryngeal framework in detail to establish landmarks for laryngeal surgery. Laryngeal structures are often highly variable and asymmetric. Maue and Dickson described the difference between the male and female anatomy, with significant differences in absolute dimensions and relative proportions.[1] Friedrich and Lichtenegger examined 50 larynges to quantify the framework, including surface structures, distances, and angles, and concluded again that the laryngeal structure was highly variable.[2] Surgical planning, however, should be based on relative proportions and anatomical landmarks such as the oblique line (line connecting the superior and inferior thyroid tubercle of the thyroid lamina).[3]

Given the complexity of these laryngeal structures, changes in the laryngeal cartilage anatomy can represent a diverse differential of the underlying pathology such as benign lesions, malignancies, trauma, or autoimmune disease. Uncommonly, abnormalities can represent anatomic variants without any underlying pathologies. In the larynx, anatomic abnormalities can cause significant and bothersome symptoms. For example, variants of the superior cornu of the thyroid cartilage can cause symptoms such as odynophagia and a foreign body sensation.[4] Anatomic variations can also be a source of diagnostic confusion. An example of this is a calcified triticeous cartilage, which can be misinterpreted as carotid calcifications.[5] The low incidence of laryngeal cartilage anomalies leads to diagnostic confusion and unnecessary investigations.

Urban et al recently described a similar anatomic concept of hemilaryngeal microsomia.[6] They described a series of six patients with a congenital structural anomaly of a similar nature.

We present here a retrospective case series of patients with an anatomic variant of the thyroid cartilage.

MATERIALS AND METHODS

Approval was obtained from the University of British Columbia Institutional Review Board. A retrospective chart review was performed on outpatient clinic visits at a tertiary care laryngology practice ranging from January 1996 to October 2016. Charts with key words including buckled thyroid cartilage, thyroid cartilage variant or anomaly, cartilage deformity, anatomical variant, inward protrusion of cartilage, and protrusion of false cord were reviewed. Data collected included age, sex, past medical history, medications, duration and frequency of symptoms, radiological imaging data, clinical examination findings, and clinical outcomes. Only patients who were confirmed to have fullness or asymmetry as documented by both laryngoscopy and computed tomography (CT) scan were included in this study. Inclusion criteria included a diagnosis of a thyroid cartilage anomaly on clinical exam and radiological confirmation of the anomaly. Specifically, inclusion criteria were 1) physical exam finding buckled thyroid cartilage, 2) laryngoscopy features suggestive of buckled thyroid cartilage (false vocal fold asymmetry or fullness), and 3) CT scan confirming the laryngeal abnormality. We did not

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Original study: This material has never been published and is not currently under evaluation in any other peer-reviewed publication.

Level of evidence: This manuscript presents a case series. The level of evidence proposed is Level 4.

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include a control group in this study and, therefore, results are summarized descriptively as a case series. A total 11 patients met the inclusion criteria and were included in the case series.

THEORY

A thorough understanding of the laryngeal anatomy and variations that may result in symptoms is important to any clinician involved in the treatment of the larynx. Given that the anatomical structural variations in the laryngeal cartilages can manifest with symptomology with a diverse differential diagnosis, comprehensive descriptions of anatomical differences are an important aspect of scientific study. The low incidence of laryngeal cartilage anomalies leads to diagnostic confusion due partially to the lack of descriptive literature.

The case series presented in this article is a unique and important addition to existing literature. This retrospective case series of patients with an anatomic variant of the thyroid cartilage will add to the understanding of laryngeal variation and also help further study the complex anatomy of the larynx.

RESULTS

We identified 11 patients with evidence of an inward buckling of the thyroid cartilage based on endoscopic findings and CT scans. The most common presenting complaints were hoarseness (54%), globus sensation (45%), or vocal fatigue (27%). Other complaints included chronic cough, throat clearing, and other voice-related complaints. Mean age was 63.3 years (range 23–85). There was a male predominance (82%, n = 9). The presentation of all 11 patients is summarized in Table 1.

All patients had a prominent false vocal fold ipsilateral to the side of the buckled thyroid cartilage on endoscopic examination. Figure 1 shows examples of patients with the characteristic endoscopic appearance and their associated CT findings. All patients demonstrated an obvious deformity of the underlying thyroid cartilage on imaging, with a characteristic inward buckling.

Only one patient in our series had a history of known laryngeal trauma. The patient reported a remote history of blunt trauma to the anterior neck from a hockey puck, resulting in occult

TABLE 1.
Summary and Description of Reference Buckled Thyroid Cartilage Cases

Case	Age	Sex	Side	Symptoms	Laryngoscopic Findings	CT Scan	Trauma
A	67	F	L	Hoarseness, chronic cough, choking spells	Submucosal fullness in false cord	Medially buckled thyroid ala	No
B	62	M	L	Hoarseness, globus	Submucosal fullness in false cord	Medially buckled thyroid ala	No
C	55	M	L	Hoarseness, vocal fatigue	Submucosal fullness in false cord, prolapsed ventricular mucosa	Medially buckled thyroid ala	No
D	64	M	R	Globus	Submucosal fullness in false cord	Medially buckled thyroid ala	No
E	78	M	L	Hoarseness, vocal fatigue	Submucosal fullness in false cord	Medially buckled thyroid ala	No
F	23	M	L	Hoarseness, globus	Submucosal fullness in false cord	Fractured thyroid cartilage with medial buckling	Blunt neck trauma
G	85	M	L	Globus, chronic cough	Fullness of false cord and supraglottic area, mild right-cord paresis	Medially buckled thyroid ala (mild)	No
H	59	M	R	Chronic throat discomfort, dysphonia, dysphagia	Fullness in supraglottic larynx, extensive posterior glottic pachydermia in the posterior glottis	Medially buckled thyroid ala	No
I	51	F	L	Hoarseness	Reinke's edema and polypoid degeneration of the left vocal cord, prominence of L false cord	Medially buckled thyroid ala (mild)	No
J	70	M	L	Chronic cough, globus	Submucosal swelling of the false vocal cord, postglottic interarytenoid edema and erythema	Medially buckled thyroid ala	No
K	82	M	L	Husky voice, left throat discomfort, throat clearing	Full and irregular membranous vocal cord	Medially buckled thyroid ala (moderate)	No

Abbreviations: CT, computed tomography; F, female; L, left; M, male; R, right.