

Horner's syndrome subsequent to minimally invasive video-assisted thyroidectomy in two patients

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Abstract. Horner's syndrome (HS), characterized by a combination of ptosis and miosis, is an uncommon complication of thyroid surgery, particularly in minimally invasive thyroid surgery. Two cases of HS were observed secondary to minimally invasive video-assisted thyroidectomy in the Department of Thyroid Breast Surgery of Zhejiang Provincial People's Hospital between August 2012 and July 2014. The two patients developed miosis and ptosis following total thyroidectomy; all symptoms had resolved at 1 and 11 months subsequent to surgery, respectively. HS has currently been reported secondary to numerous types of minimally invasive thyroid procedures. The literature was reviewed to identify cases of this iatrogenic complication secondary to each type of thyroidectomy and the possible injury mechanisms underlying the syndrome were summarized in the present study. In addition, factors that were associated with minimally invasive thyroidectomy, such as the limited endoscopic vision during the procedure, the retraction effect and the occurrence of thermal damage from the use of the harmonic scalpel, were emphasized. The present study concluded that close attention is required during minimally invasive thyroid surgery in order to avoid HS as a complication of the procedure.

Introduction

Horner's syndrome (HS), which was first described by Horner in 1869, is a condition that is characterized by the triad of ptosis, miosis and anhidrosis (1). The occurrence of HS has previously been revealed to be associated with damage to the oculosympathetic pathway (OSP) (2), which is a component of the sympathetic nervous system that affects the eyes.

Additional clinical symptoms of HS, including enophthalmos and vascular dilation, can also be observed subsequent to injury of the OSP.

Although neck surgery is a frequent iatrogenic cause of HS, thyroid surgery-associated HS is rare (3). A previous study reporting the occurrence of HS secondary to thyroidectomy mostly attributed the development of HS to conventional thyroidectomy (4).

Since the first study reporting the use of minimally invasive video-assisted thyroidectomy (MIVAT) in 1998 (5), this surgical procedure has been widely performed due to its satisfactory cosmetic result and the minor pain experienced by the patient (6). In the present study, the cases of two patients that developed HS subsequent to MIVAT are reported, and a review of the literature is performed to interpret the possible injury mechanisms that led to HS following thyroid surgery, particularly in minimally invasive thyroidectomy.

Materials and methods

Patients who underwent MIVAT between August 2012 and July 2014 at the Department of Thyroid Breast Surgery of Zhejiang Provincial People's Hospital (Hangzhou, Zhejiang, China) were retrospectively reviewed in the present study. The records were evaluated to determine the medical history, pathology and follow-up information of the patients.

In all patients, the surgical procedure was conducted using a gasless endoscopic method, with retractors maintaining the surgical space. The vessels were ligated using UltraCision Harmonic Scalpel (Ethicon Endo-Surgery, Inc., Blue Ash, Cincinnati, OH, USA) until the lobe was completely freed. The recurrent laryngeal nerve was checked prior to the removal of the thyroid lobe. Lymph node dissection was also performed using the UltraCision Harmonic Scalpel. All dissected tissue was extracted by gently drawing the tissue through a 1.5-cm incision in the skin.

Results

A total of 416 patients received MIVAT between August 2012 and July 2014. Of procedures performed, 76 were lobectomy, 42 were total thyroidectomy, 51 were near-total thyroidectomy, 107 were lobectomy with central lymph node dissection

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Table I. Clinical characteristics of patients with Horner's syndrome.

Patient	Age, years	Gender	Diagnosis	Surgical procedure	Time to resolution, months
1	30	F	Right papillary carcinoma	Total thyroidectomy + prophylactic CLND	11
2	43	F	Bilateral papillary carcinoma	Total thyroidectomy + prophylactic CLND + right parathyroid transplantation	1

F, female; CLND, central lymph node dissection.

Table II. Reported cases of Horner's syndrome related with thyroid surgery.

First author (Ref.)	Number of patients, n	Type of procedure	Time to resolution	Pathological diagnosis
Kang <i>et al</i> (11)	1	RAET	NM	NM
Lee <i>et al</i> (12)	1	RAET	NM	NM
Rosato <i>et al</i> (13)	1	Conventional	NM	NM
Italiano <i>et al</i> (14)	1	Conventional	2 months	Multinodular goiter
de Silva <i>et al</i> (15)	1	Conventional	3 months	Degenerating colloid nodule
Vilallonga <i>et al</i> (16)	1	Conventional (secondary)	No improvement	Poorly differentiated insular carcinoma
Aslankurt <i>et al</i> (17)	1	Conventional	No improvement	Multinodular goiter
Harding <i>et al</i> (10)	2	Conventional	Partial resolution in 1 patient; no improvement in 1 patient	Papillary carcinoma and medullary thyroid cancer, respectively
	1	OMIT	Partial resolution	Parathyroid adenoma, normal thyroid nodule
	3	Conventional (secondary)	No improvement	Papillary carcinoma
Tan <i>et al</i> (18)	1	OMIT	3 months	Follicular carcinoma
Lee <i>et al</i> (19)	5	Conventional	NM	Malignant
Solomon <i>et al</i> (9)	1	Conventional	15 months	Multinodular goiter
Cozzaglio <i>et al</i> (3)	1	Conventional	3 days	Basedow-Graves' disease
González-Aguado <i>et al</i> (20)	1	Conventional	5 months	Papillary carcinoma

RAET, robotic-assisted endoscopic thyroidectomy; OMIT, open minimally invasive thyroidectomy; NM, not mentioned.

(CLND), 99 were total thyroidectomy with CLND, and 41 were near-total thyroidectomy with CLND. Among this population, HS was post-operatively identified in two female patients, aged 30 and 43 years old, who were diagnosed with right papillary carcinoma and bilateral papillary carcinoma, respectively. The two patients had undergone minimally invasive video-assisted total thyroidectomy and prophylactic central neck lymph node dissection (level VI). The patient with bilateral papillary carcinoma also underwent right parathyroid transplantation. The clinical characteristics of the patients are summarized in Table I.

The patient diagnosed with right papillary carcinoma demonstrated miosis and narrowing of the palpebral fissure on the right side on post-operative day one, and mecobalamin tablets were administered immediately; this course of medication was

discontinued after one week as no improvement was observed. The symptoms gradually resolved over a period of 11 months subsequent to surgery. No other complications, such as hematoma, inflammation and vocal cord palsy, were detected in this patient. The second patient, who had been diagnosed with bilateral papillary carcinoma, complained of discomfort of the right eye on post-operative day three. Following an ophthalmic test, HS with the presentation of right miosis and ptosis was diagnosed. No clinical signs of hematoma or other complications were spontaneously detected, and all symptoms had improved 1 month later; no treatment was administered during this period.

Subsequent to a follow-up periods of 21 and 14 months, respectively, the two patients demonstrated no evidence of disease recurrence or reported any discomfort.

Discussion

The occurrence of an iatrogenic cervical sympathetic lesion following thyroid surgery was first described by Kaelin in 1915 (7). Few cases have been reported since, and the majority of cases are associated with conventional thyroidectomy (8). To the best of our knowledge, there have been only 18 cases involving the development of HS as a complication of conventional thyroid surgery since 1993 (Table II) that have been reported in the literature (3,9-20). Due to the development of surgical techniques over the previous two decades, cervical sympathetic damage has also been reported as a post-operative complication that develops subsequent to the completion of open minimally-invasive thyroidectomy and robotic-assisted endoscopic thyroidectomy (Table II).

The potential mechanisms underlying this complication may differ between certain surgical procedures. HS has been confirmed to be induced by direct injury of the cervical sympathetic pathway due to anatomical factors (9). The OSP at the C8-T2 level, where second-order neurons are located, demonstrates a notable association with iatrogenic injury. In this preganglionic segment, the fibers of OSP arise from white rami communicantes at the first thoracic segment and join with the sympathetic chain. The fibers then pass through the inferior and middle cervical ganglion and finally synapse in the superior cervical ganglion (2). The middle cervical ganglion (10) and its thyroid branches (3) lie adjacent to the inferior thyroid artery, which originates from the thyrocervical trunk. Due to the anatomical contiguity in this component, the OSP is continuously at risk of injury during the procedure of lobectomy. In addition, the inferior thyroid artery has been reported to supply the sympathetic chain, which can be affected due to ligation of this artery (9). Partial nervous dysfunction arises from this ischemic damage. Furthermore, an anatomical study has previously demonstrated that anastomosis occurs between the recurrent laryngeal nerve and the cervical sympathetic chain in certain individuals (21). Therefore, isolation and identification of the recurrent laryngeal nerve may also exert trauma on the sympathetic chain. Considering the aforementioned anatomical aspect, direct sympathetic nerve lesions resulting from extensive dissection or neurovascular manipulation are one core etiological factor that leads to iatrogenic HS. In addition to direct injury, post-operative compression of the OSP due to hematoma and inflammation is another underlying cause (10).

Since the present cases occurred subsequent to MIVAT, HS was also potentially attributed to a number of elements. Firstly, due to the limited space that restricts the freedom of endoscopy, the whole branches of certain vessels or nerves could not be completely observed from one endoscopic vision while manipulating the adjacent structure to avoid injury. Secondly, the necessity of exposure in minimally invasive surgical techniques means that the retraction effect cannot be disregarded while revealing the lateral gland and neighboring structure. It has been hypothesized that stretching of the carotid sheath may also result in minor neural trauma (22). Thirdly, ultrasonically activated (US) instruments possess the two advantages of cutting and coagulation, and play a significant role in minimally invasive

thyroid surgery. Carlander *et al* reported nerve dysfunction induced by the local energy effect from US instruments in a rat model. This study also considered that the degree of nerve damage depended on the duration of heat exposure (23). It has also been revealed that higher rates of transient recurrent laryngeal nerve palsy occur subsequent to the use of US instruments compared with conventional techniques (24). According to such evidence, thermal damage from the harmonic scalpel during the surgical procedure is another possible cause of HS, particularly in patients with sympathetic anatomical variations.

In the present patients, transient HS occurred immediately subsequent to surgery. No signs of post-operative hematoma were found in either patient. Accordingly, the potential causes of HS in the present patients were considered, including pressure from retractors and heat damage from the use of the harmonic scalpel.

Damage to the cervical sympathetic pathway due to thyroid surgery is rare. However, the present study indicates that close attention is required during minimally invasive procedures while ligating vessels and isolating tissue using US instruments. Surgeons should be aware of the possible anatomical complexity of the OSP and the association between the pathway and adjacent structures.

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