Posterior hyoid space; a brilliant concept in managing thyroglossal duct cyst (TGDC)

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Introduction
Thyroglossal duct cyst and/or fistula represent the most common congenital anomalies of the neck. Many procedures have been described for excising thyroglossal cysts. These procedures vary from simple cyst excision to anterior block neck dissection.
Objective
The aim of the paper was to evaluate the concept of posterior hyoid space according to the Maddalozzo modification of the Sistrunk operation.
Patients and methods
This prospective study was carried out at the general surgery departments of Benha and Zagazig University Hospitals. Twenty-eight patients diagnosed with primary thyroglossal duct cyst were included in this study. The surgical technique used was that described by Maddalozzo *et al.*
Results
Twenty (71%) patients had anterior neck cystic swelling and eight (29%) patients had neck fistula. After histopathological examination, the tract passed in front of the hyoid bone in all cases (100 %), whereas ectopic thyroid follicles were detected ventral to the hyoid bone in 11 (39%) cases, behind the hyoid bone in three (11%) cases, and in four (14%) cases, it was found in both the ventral and the dorsal position.
Conclusion
Our results were promising, and this approach of posterior hyoid space should be studied more extensively for assessment of its efficacy and benefits. This method should also be used to evaluate the possible role of ectopic thyroid tissues in recurrence with the use of the classic Sistrunk procedure.

Keywords:
posterior hyoid space, Sistrunk operation, thyroglossal cyst

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Introduction

The thyroid gland originates at the foramen cecum and descends anterior to the pharynx to its final position close to the larynx [1]. During the second gestational month, this pathway is divided by the hyoid bone into upper and lower segments. The failed thyroglossal tract obliteration, or retained epithelial cysts, gives rise to thyroglossal duct cysts (TGDCs) [2]. Knowledge of the thyroglossal tract exact path, especially in relation to the hyoid bone, remains the most important factor in determining the optimum treatment for TGDCs [3]. Although extensive descriptive data on the operative treatment and the pathology of surgical specimens of TGDCs are available today, only limited and contradictory information on the anatomic course of the thyroglossal tract in relation to the hyoid bone can be found in the literature [4–7].

Some debate persists around The topographic course of thyroglossal tract. Sprinzl *et al.* [8] used – for the first time – serially step-sectioned histologic autopsy specimens for the assessment of thyroglossal tract remnants. They reported that 41.3% of specimens (24/58 specimens) showed remnants of the thyroglossal tract or ectopic thyroid tissue. Four specimens showed complete thyroglossal tracts and ectopic thyroid tissue. The tract remained ventral to the hyoid bone in all planes. However, they found ectopic thyroid follicles alone in 20 specimens. The thyroid follicles were located in ventral, dorsal, and a combination of ventral and dorsal positions in 11, three, and six specimens, respectively.

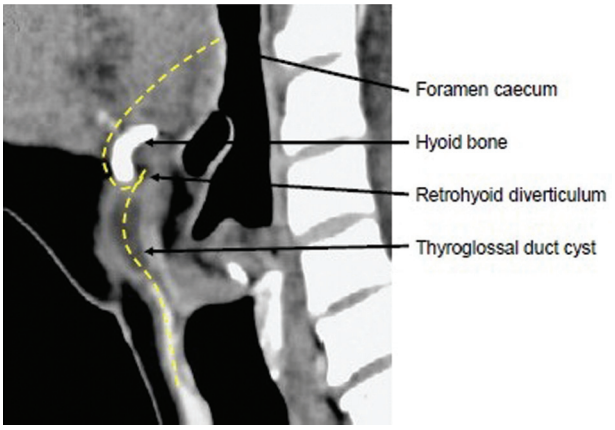
Other authors believed that a persistent thyroglossal duct courses anterior to, and rarely through, the hyoid body, and often has a diverticulum that hooks below and behind the hyoid bone [9] (Fig. 1). This variation

in understanding the embryological development is reflected in the mode of excision of the cyst.

A wide range of procedures have been described for the management of thyroglossal cysts. These procedures vary from simple cyst excision to anterior block neck dissection. A simple cystectomy showed a higher recurrence rate [10]. In 1893, Schlang [11] described a procedure to remove central part of the hyoid bone in continuity with the main cyst. In 1920, Sistrunk [12] described aprocedure of excision of the cyst in continuity with the central part of the body of the hyoid bone and the core of the tongue muscle up to the foramen cecum. The use of the Sistunk procedure led to a lower recurrence rate (about 4–14%) and is considered the gold standard for the treatment of thyroglossal cysts [13,14].

Maddalozzo *et al*. [15] modified the Sistrunk approach to include skeletonization of the thyroid cartilage to identify the alae and notch of the cartilage (Fig. 2). The thyrohyoid membrane is then identified and used to locate the posterior aspect of the hyoid bone and to evacuate the posterior hyoid space (PHS).

Figure 1



Course of the thyroglossal tract

The PHS is outlined inferiorly by the inferior margin of the hyoid, superiorly by the superior margin of the hyoid and thyrohyoid membrane, anteriorly by the posterior surface of the hyoid, and dorsally by the thyrohyoid membrane (Fig. 3). This approach facilitates complete resection of the hyoid and exposure of the PHS, enabling evacuation of abnormal tissue from this area [15].

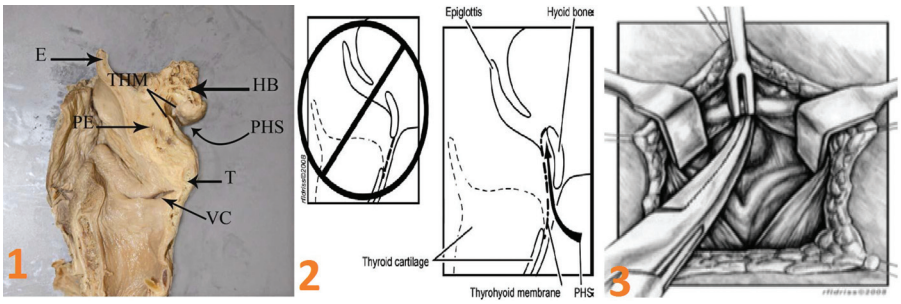
The aim of this study is to evaluate the concept of the PHS according to the Maddalozzo modification of the Sistrunk operation.

Patients and methods

This prospective study was carried out at general surgery departments of Benha and Zagazig University Hospitals after obtaining approval from the local ethical committee and after a fully informed written consent was signed by the patients' parents. This study was carried out from April 2013 to November 2016. This duration (about 44 months) allowed for patients' selection and at least a 12-month follow-up period from the last case operated upon.

Twenty-eight patients diagnosed with primary TGDC were included in this study after proper treatment of recent infection to ensure that they did not have infection for at least 6 weeks before surgery. The diagnosis of a TGDC was made on the basis of a thorough assessment of history and a physical examination (midline neck mass, which moves with deglutition and with tongue protrusion). Recurrent cases were excluded from this study. Also, patients with pathology other than TGDC were retrogradely excluded. Neck ultrasonography is a routine investigation method for cyst assessment and to visualize the thyroid gland in its normal position. Routine preoperative laboratory tests were also performed for all cases. Thyroid function tests were

Figure 2



Autopsy and diagrams showing posterior hyoid space

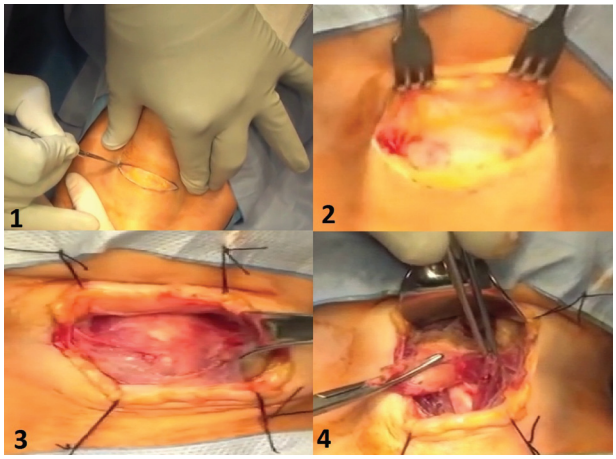
not performed routinely in cases of thyroglossal cysts if the patient was clinically euthyroid.

Surgical technique

The surgical technique as described by Maddalozzo *et al.* [15] was used. A horizontal incision approximately 4 cm in length was made in a skin crease inferior to the lesion and carried through subcutaneous tissue and platysma. Upper and lower flaps were created in the subplatysmal plane. Superiorly, the flap was elevated up to the inferior part of the submental triangle of the neck. Inferiorly, the flap was extended to expose the thyroid cartilage (Fig. 3). The strap muscles were retracted along the midline and dissection was extended to the level of the thyroid cartilage. The alae and notch of the thyroid cartilage were exposed. The thyrohyoid membrane was exposed (Fig. 4) and dissection was carried out superficially until identification of the posterior aspect of the hyoid bone and the space between the bone and membrane (PHS). The hyoid bone could then be clearly visualized and grasped with an Allice clamp and transected medial to the tendon of the digastric muscle. Further suprahyoid dissection was carried out to remove a core of tissues up to lingual musculature where the specimen was transected (Fig. 5). The tongue defect was repaired and the wound was drained before closure.

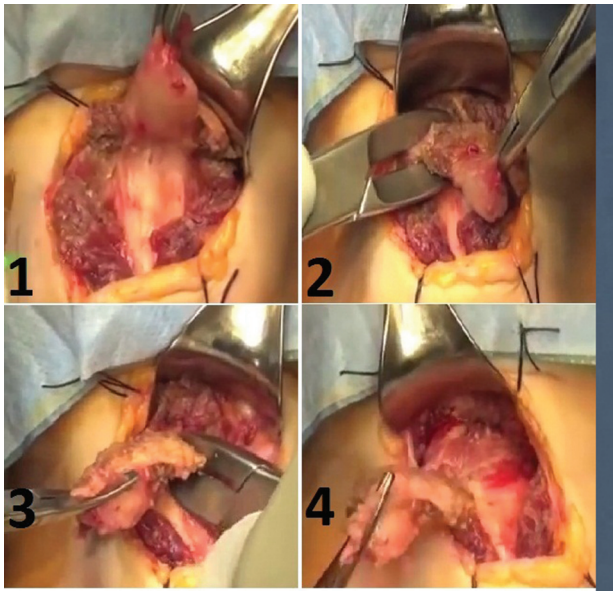
All patients received aprophylactic antibiotics. All specimens were examined histopathologically to locate the thyroglossal tract with or without ectopic thyroid tissues. Also, the relation of these tissues (tract

Figure 3



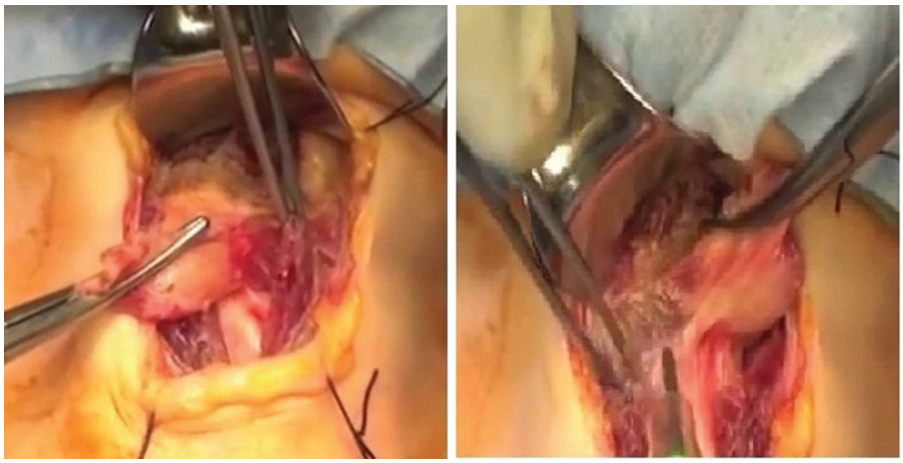
Surgical steps: 1, incision; 2, subplatysmal plane; 3, raising flaps; 4, strap muscles retraction

Figure 5



Surgical steps: 1, entry into posterior hyoid space; 2,3, cutting of the hyoid bone; 4, suprahyoid dissection

Figure 4



Exposure of the thyrohyoid membrane

and ectopic thyroid tissues) to hyoid bone was determined.

Results

The study group included 28 patients, 16 (57%) males and 12 (43%) females, with a mean age of 5.3 years (2.9–17.2 years) (Table 1). The history of the disease varied from 3 months to 2.7 years. Twenty (71%) patients had anterior neck cystic swelling and eight (29%) patients had neck fistula (Table 2).

After a histopathological examination, the tract passed in front of the hyoid bone in all cases (100 %), whereas ectopic thyroid follicles were detected in 18 (64%) patients (Fig. 6). Eleven (39%) patients had ectopic thyroid tissues ventral to the hyoid bone, in three (11%) cases, ectopic thyroid tissues were behind the hyoid bone, and in four (14%) cases, ectopic thyroid tissues were found in both the ventral and the dorsal position. In all cases, during perihyoid dissection, we found a single tract. However, suprahyoid dissection was carried out as an enblock excision of 1 cm core of tissues till lingual musculature, without any trial of skeletonization of the suprahyoid portion of the tract. Only two (7%) patients had a superficial wound infection, and this was treated successfully by oral second-generation cephalosporin. No other complication or recurrence was reported during the follow-up period (Table 2).

Table 1 Demographic data (original)

Age (years)	2.9–17.2 (5.3)	
Sex		
Male : female [*n* (%)]	16 (57)	12 (43)

Table 2 Clinical and pathological findings (original)

	n (%)
Presentation	
Cysts	20 (71)
Fistula	8 (29)
Track (single or multiple) (%)	
All cases had a single track	100
Relation to hyoid bone (%)	
All tracks were ventral to the hyoid bone	100
Ectopic thyroid tissues (*N*=28)	
Number of cases detected in patients	18 (64)
Cases (ventral to the hyoid)	11 (39)
Cases (dorsal)	3 (11)
Cases (combined ventral and dorsal)	4 (14)
Postoperative complications	
Cases of wound infection	2 (7)
No recurrence (%)	0

Discussion

TGDC and/or fistula represent the most common congenital anomalies of the neck, representing more than 70–75% of congenital midline neck masses. Post mortem examination of adult larynges suggested that TGDC remnants may be present in 7% of the population [15].

Management varies widely, ranging from simple drainage, cystectomy, tract excision, tract plus hyoid bone excision to extended excision or even anterior block neck dissection [10–12,16].

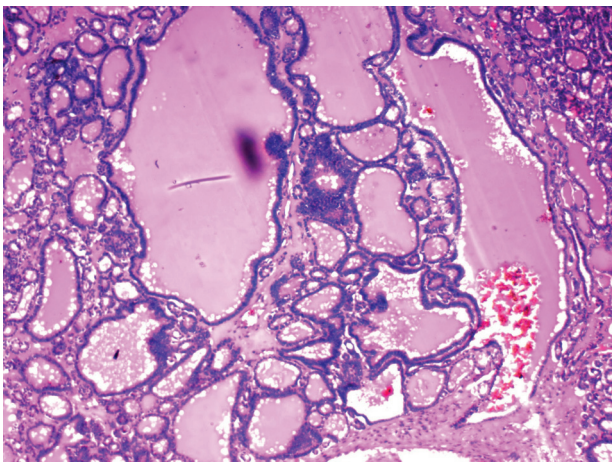
A simple cystectomy was associated with a high recurrence rate (50%). Schlang [11] carried out hyoid bone excision and found a significant reduction in the recurrence rate to 20%. Sistrunk [12] followed the same Schlang principles and also performed suprahyoid dissection; he reported a greater reduction in the recurrence rate (4–14%) [17].

Moreover, the extended dissection approach was described by Valentina and Fabio [16], but they limited the indication of this technique to recurrent cases.

Maddalozzo *et al.* [15] created a brilliant technique between all these modifications of the Sistrunk operation. They introduced the concept of the PHS, which is an anatomically undescribed area. This concept not only ensures complete tract excision but also eradication of abnormal ectopic thyroid tissues.

Previously, it was believed that the main cause of recurrence is an unexcised residual part of the tract [18]. However, even after clear tract excision, recurrence still occurred.

Figure 6



Section from ectopic thyroid tissue showed thyroid follicles. Haemotoxylin and eosin, ×200

Sprinzl *et al.* [8], for the first time, used serially step-sectioned histologic autopsy specimens. They highlighted the perihyoidal distribution of abnormally ectopic thyroid tissues with a constant position of the tract anterior to the hyoid bone. The study of Sprinzl *et al.* [8] was a strong support to the concept of the PHS.

This study evaluated the PHS concept, and we found that it is an excellent modification of the Sistrunk operation. This approach leads to a complete eradication of a TGDC, tract, and hyoid bone and evacuation of the PHS with its possible contents of ectopic thyroid tissues and it is still a simple and easy to perform technique.

In this study, we found the thyroglossal tract at a constant position anterior to the hyoid bone. However, Chandra *et al.* [19] reported that in ~30% of cases, the tract has been found posterior to the hyoid bone.

In this study, we encountered no recurrence over the entire 12-month follow-up duration. Maddalozzo *et al.* [15] used the same technique that was described here, and reported a 1.05% recurrence rate in a series of 95 patients. Their results still showed a significant reduction in the recurrence rate compared with the use of the classic Sistrunk operation. As reported by Mondin *et al.* [20], in their extensive 2008 review, they carried out a meta-analysis to combine the recurrence rates of TGDC after a classic Sistrunk operation from 13 reported series involving 950 patients. They reported a recurrence rate of 6.6% [20].

Also, pathological studies reported the constant position of TGDC and the tract ventral to the hyoid bone with the plane of cleavage in between. Moreover, we also highlight the important possible role of ectopic thyroid tissues that were found in the perihyoid area. Ectopic thyroid tissues were found in 64% of cases. the relation of ectopic thyroid tissues with hyoid bone was anterior, posterior, and combined anterior and posterior to the hyoid bone in 39, 11, and 14% of cases, respectively. These results are comparable with those reported by Sprinzl *et al.* [8], they found that ectopic thyroid tissues were 55, 15, and 30% in anterior, posterior, and combined anterior and posterior positions in relation to the hyoid bone [8]. It is still unclear to consider ectopic thyroid tissues a cause of recurrence of thyroglossal cysts. For further evaluation, subsequent researches should be carried out on a wide scale.

Our results were promising as we encountered no recurrence over a follow-up period of 12 months. The relatively small number of cases in this study is a limiting factor, and this approach of PHS should be studied more extensively for assessment of its efficacy and benefits. Also, the possible role of ectopic thyroid tissues in recurrent cases with the use of the classic Sistrunk procedure should be studied.

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Nil.

Conflicts of interest
There is no conflict of interest.

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