The Relationship Between the Location of Thyroglossal Duct Cysts and the Epithelial Lining

Aiman A. Ali · Badr Al-Jandan · C. S. Suresh ·
Ahmad Subaei

Received: 25 April 2012 / Accepted: 29 August 2012 / Published online: 12 September 2012
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Abstract Thyroglossal duct cysts (TDCs) with ambiguous epithelial lining are the most common midline cervical anomaly encountered in children. To histopathologically study the epithelial lining of 32 thyroglossal duct cysts in relation to their locations. A total of 32 cases of thyroglossal duct cysts were collected for this study. The samples were classified into 3 groups as follows: (1) above the hyoid bone; (2) at the level of hyoid bone; (3) below the hyoid bone. All samples were H&E stained. Seventeen TDCs (53 %) were found above the hyoid bone, 6 (18.8 %) were found at the level of hyoid bone and 9 (28.1 %) were found below the hyoid bone. Of the 32 total cases, 6 (18.8 %) were lined with stratified squamous epithelium (SSE), 17 (53 %) were lined with pseudostratified ciliated epithelium (PSCE), 3 (9.4 %) were lined with stratified cuboidal epithelium (SCE), and 6 (18.8 %) exhibited both SSE and PSCE. Pseudostratified ciliated epithelium was dominant in the region superior to the hyoid bone, whereas SCE was detected only in TDCs at the level of hyoid bone. These differences were statistically significant ($P = 0.0001$). Different types of epithelial lining were detected in the study samples of TDCs. A statistically significant correlation was found between the type of

epithelium detected and the location of the TDC at the time of diagnosis.

Keywords Thyroglossal duct cyst · Stratified squamous epithelium · Pseudostratified ciliated epithelium · Stratified cuboidal epithelium

Introduction

Although thyroglossal duct cysts (TDCs) can be found anywhere along the thyroglossal tract (TT), the majority of them occur in the midline of the neck close to the hyoid bone [1]. An understanding of the embryology of the thyroid gland is the basis for the management of thyroid anomalies. The thyroglossal duct is an epithelial tube that connects the gland and the foramen cecum. The attenuated thyroglossal duct tract usually atrophies and disappears by the end of the eighth week. This tract may persist as a fibrous cord or as a minute epithelial tube [2, 3]. The thyroid gland may reach its normal position, leaving the remainder of the cells anywhere along this embryonic path that can give rise to the postnatal development of cysts. TDCs never have a primary external opening because the embryologic course of the tract does not reach the surface of the neck [4, 5].

TDCs can be situated anywhere along the developmental tract, from the foramen cecum in the tongue base to the suprasternal region. In general, the vertical location of TDCs is described as lingual, supra-hyoid (including submental), thyrohyoid (between the hyoid bone and thyroid cartilage) or suprasternal. The majority of TDCs occur in close proximity to the hyoid bone. In a meta-analysis, Allard collected 381 cases of well-documented TDCs and reported the following locations: 2.1 % lingual, 24.1 %

A. A. Ali (✉) · B. Al-Jandan · C. S. Suresh · A. Subaei
Department of Biomedical Dental Sciences,
College of Dentistry, University of Dammam,
P O Box: 60710, Dammam 31555, Saudi Arabia
e-mail: aiman.a.ali@gmail.com

B. Al-Jandan
e-mail: badraljandan@hotmail.com

C. S. Suresh
e-mail: drsureshcs@yahoo.com

A. Subaei
e-mail: dent.aes@hotmail.com

supra-hyoid, 60.9 % thyrohyoid and 12.9 % suprasternal [4, 5].

Clinically, the most common presentation of TDC is a painless cystic mass in the region of the hyoid bone at or near the midline. Most thyroglossal duct cysts present during the first 5 years of life, although the lesion has repeatedly been described during adulthood [5]. Because of its relationship to both the hyoid bone and foramen cecum, the cyst typically moves cranially with swallowing and protrusion of the tongue. These manoeuvres may be difficult to elicit in small children [6]. Thyroglossal duct remnants are lined by ductal epithelium and may contain solid thyroid tissue. Approximately 1.5 % of patients with a preoperative diagnosis of thyroglossal duct cyst are found to have median ectopic thyroid tissue at the time of surgery. In these patients, the only functional thyroid tissue is located within the mass. These patients are frequently hypothyroid, with elevated TSH levels and resultant hypertrophy of the ectopic thyroid tissue [7].

Histopathologically, the epithelial lining of thyroglossal duct cysts is of variable types, and its relationship to location and other clinical factors is unclear. Squamous epithelium or pseudostratified ciliated epithelium may line the cysts. Occasionally, the cysts may become devoid of epithelium, although this is generally secondary to inflammation, especially when the cysts have an attached sinus tract [2].

It is well known that the epithelial lining of nasopalatine duct cysts is related to its location; when it is located near the oral cavity, the epithelial lining usually is stratified squamous, and when it is near the nasal cavity, it is usually of pseudostratified ciliated epithelium [8]. This observation initiated the present study to explore whether there is any relationship between the location of the TDC and its epithelial lining. The main purpose of this study is to link the location of TDCs with their histological characteristics.

Materials and Methods

A total of 54 cases of thyroglossal duct cyst were collected from 4 main referral hospitals. The samples collected were reported between 1998 and 2007. Of these, only 32 cases were found to match the selection criteria of our research (availability of paraffin blocks and with complete clinical data). Twenty-six cases were reported in males and six in females. The mean age was 24.1 years with a standard deviation of 22.95.

The samples were classified into 3 groups according to the location stated in the surgical report:

- Group I: TDCs located above the hyoid bone.
- Group II: TDCs located at the level of the hyoid bone.
- Group III: TDCs located below the hyoid bone.

Basic Histological Preparation

Paraffin blocks were collected from all of the groups. Four-micron sections were prepared from each block. The sections were deparaffinised, placed on a slide and stained using routine H&E staining. The stained slides were then examined using a light microscope to determine the nature and origin of the epithelial lining of each sample.

Statistical Analysis

All collected data were fed into the computer for statistical analysis. The SPSS and Epi Info 2000 programs were used. A *P* value less than 0.05 and a confidence interval of 95 % were considered statistically significant.

Results

Of the 32 cases studied, twenty-six (81.25 %) were reported in males, and six (18.8 %) were reported in females. The mean age was 24.1 years with a standard deviation of 22.95.

In our samples, 17 (53 %) of the cysts were found above the hyoid bone, 6 (18.8 %) were observed at the level of hyoid bone and 9 (28.1 %) were located below the hyoid bone. Six (18.8 %) samples were lined by stratified squamous epithelium (SSE) (Fig. 1), 17 (53 %) by pseudostratified ciliated epithelium (PSCE) (Fig. 2), 3 (9.4 %) by stratified cuboidal epithelium (SCE) (Fig. 3), and 6 (18.8 %) by a combination of SSE and PSCE (Fig. 4).

Our data indicate that 14 (82.3 %) of the 17 cysts found superior to the hyoid bone were lined by PSCE, and 3 (17.7 %) were lined by SSE. Among the 6 cysts detected at the level of hyoid bone, 3 (50 %) were lined by PSCE, and

Fig. 1 Stratified squamous (non-keratinised) epithelium in a thyroglossal duct cyst (high magnification)

Fig. 2 Pseudostratified ciliated epithelium in a thyroglossal duct cyst (high magnification). 1 Cilia, 2 Pseudostratified columnar epithelium

Fig. 3 Stratified cuboidal epithelium in a thyroglossal duct cyst exhibiting desquamated cells in its lumen (red arrows) (high magnification)

Fig. 4 Combination of pseudostratified ciliated and squamous stratified epithelium in a thyroglossal duct cyst (high magnification)

3 (50 %) were lined by SCE. Of the 9 cysts found inferior to hyoid bone, 3 (33.3 %) were lined by SSE, and 6 (66.7 %) were lined by a combination of SSE and PSCE (Fig. 1). Pseudostratified ciliated epithelium (PSCE) was the dominant epithelial type observed in cysts superior to the hyoid bone, whereas SCE was detected only in TDCs located at the level of hyoid bone (see Fig. 1). These differences were statistically significant ($P = 0.0001$).

Discussion

TDCs are common congenital neck masses that occur with equal frequencies in men and women and are observed in several locations along the cervical midline. TDCs are most frequently detected below the level of hyoid (85 %), above the hyoid (8 %), at the base of the tongue (1–2 %), or low in the neck (5 %) [9, 10].

In contrast to the usual infra-hyoid location, 17 (53.1 %) of the cases in our study were reportedly located in the supra-hyoid region, whereas only 6 (18.8 %) and 9 (28.1 %) cases were detected at the level of and below the hyoid bone, respectively.

Of the 32 cases reported in our study, twenty-six (81.25 %) occurred in males, and six (18.8 %) occurred in females. The mean age of the patients was 24.1 years ($SD = 22.95$). Other studies demonstrated that the majority of TDCs occur in individuals younger than 20 years of age [11]. However, 21 out of 32 (65.6 %) cases in this study occurred in individuals younger than 20 years of age.

Histologically, TDCs have an ambiguous epithelial lining. Moorthy and Arcot reported that TDCs are usually lined by stratified squamous epithelium or pseudostratified ciliated columnar epithelium [12]. The following distribution was noted regarding the epithelial lining of the TDCs in this study: six (18.8 %) samples were lined by stratified squamous epithelium (SSE), 17 (53 %) by pseudostratified ciliated epithelium (PSCE), 3 (9.4 %) by stratified cuboidal epithelium (SCE), and 6 (18.8 %) by a combination of SSE and PSCE.

To our knowledge, no studies to date have been conducted to assess any relationship between the epithelial lining of TDCs and their location at the time of diagnosis. In this study, the majority of cysts located superior to the hyoid bone were found to be lined by pseudostratified ciliated epithelium ($P < 0.05$). A strong link was noted between the location of the cyst (at the level of the hyoid bone) and type of epithelial lining (SCE), as all cysts lined by SCE (100 %) were found at this location. Moreover, all cysts lined by a combination of SSE and PSCE were found inferior to the hyoid bone ($P < 0.05$). In contrast, cysts lined by SSE were detected both superior and inferior to the hyoid bone. However, no cysts lined by SSE were found at the level of hyoid bone (see Fig. 5).

Fig. 5 Relationship between the type of epithelium and the location of TDCs

We believe that the SCE observed is not true stratified cuboidal epithelium, but it may represent SSE that suffered a severe desquamation that led to the loss of a majority of the squamous layers. In such a circumstance, the basal “cuboidal” and one suprabasal layer may have been preserved. Figure 4 may explain this hypothesis as it shows many desquamated cells in the lumen of the cyst. As this type of epithelium was noted only at the level of the hyoid bone (where SSE disappeared), the desquamation could be due to the constant pressure exerted on the cyst by the movement of the hyoid bone.

Pseudostratified ciliated epithelium (PSCE) was dominant in the location superior to the hyoid bone, which may be due to its close proximity to the upper respiratory tract.

In conclusion, different types of epithelial lining were detected in the samples of TDCs studied. Statistically significant correlations were found between the type of lining epithelium and the location of the TDCs at the time of diagnosis. These findings may help the pathologists from the diagnostic histopathological point of view.

Acknowledgments The authors would like to acknowledge the Deanship of Scientific Research, University of Dammam, Saudi Arabia for funding this research, grant number (2011035).

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