Thyroglossal cyst: Brazilian panorama

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Abstract

Introduction: Thyroglossal duct cyst (TDC) is the most commonly found cervical congenital mass, occurring in approximately 7% of the population; however, data on TDC in Brazil are scarce. Objective: To outline the Brazilian scenario in the treatment of TDC and review the literature on this theme. Methods: Retrospective epidemiological study with a descriptive approach using secondary data collected from the SIH/DataSUS (Sistema de Internações Hospitalares/Sistema Nacional de Informação em Saúde) between 2008 and 2018, along with an analysis of the revisions on TDC published over the past ten years. Results: Between 2008 and 2018, there were 23,602 hospital admissions for TDC excision, with an average of 2,145 procedures per year, resulting in an average of 11.85 procedures per 100,000 inhabitants in the period evaluated. Admissions occurred predominantly in the Southeast and Northeast regions, at an average cost of BRL 1,054,977.66 per year to the health system of the country. The literature search resulted in 52 review articles addressing the pathogenesis, diagnosis and management of TDC, which are explained in this study. Conclusion: TDC is a congenital entity predominantly treated in the country at relevant costs to the health system, demanding accuracy on the knowledge of its pathogenesis for better diagnosis and management of patients with this condition.

Keywords: thyroglossal cyst; cervical cysts; congenital malformations.

Introduction

Thyroglossal cyst (TDC) is considered a relatively rare condition with low incidence in the general population, however, it stands out as the main anomaly occurring due to incomplete obliteration of the thyroglossal duct. It is the most common congenital malformation of the neck, and thus the main differential diagnosis of cervical masses evaluated in childhood. National data on the number of procedures and treatment costs for this condition are scarce, thus hindering an outline of its prevalence. Aiming at a more accurate diagnosis and thus proceeding with the best propaedeutic, it is necessary to know the embryology and defects of the thyroglossal duct obliteration and its variants, as well as the anatomical features that delimit the area of its formation, comprising the main differential diagnoses involving anterior cervical masses; subsequently indicating the most appropriate imaging examinations to complement the investigation. To this end, an analysis of the Brazilian panorama regarding the data on the treatment for TDC was conducted, as well as a review of the current literature addressing the theme with a focus on its pathogenesis, diagnosis and treatment.
Methods
This is a cross-sectional study conducted with secondary data from the SIH/DataSUS (Sistema de Informações Hospitalares/Sistema Nacional de Informação em Saúde). Data from all hospitalizations for TDC treatment in Brazil were collected between 2008 and 2018. The term used as search parameter was that in the SUS code for the treatment: 0401020096 - THYROGLOSSAL DUCT CYST EXCISION. The variables were analyzed by year and included: number of hospitalizations, average cost per hospitalization, total cost of hospitalizations, hospital length of stay, number of deaths, and mortality rates. Descriptive analysis of the data consisted of frequency distribution of the variables and construction of mean and proportion indicators. Simultaneously, a review of the literature in English on the theme was conducted for the 2008-2019 period on studies addressing TDC published at the PubMed database using the search term “thyroglossal cyst”. Overall, 64 articles were found, and after application of the inclusion and exclusion criteria (Figure 1), 52 articles were selected for this review (Table 1).

Figure 1. Organization chart describing the research strategy for the literature review that resulted in the 52 selected review articles.

Table 1. Studies selected for the review.

| Author               | Year | Country |
|----------------------|------|---------|
| Rosenberg et al.      | 2010 | USA     |
| Friedman and John     | 2011 | USA     |
| Ibrahim et al.        | 2011 | USA     |
| Salgarelli et al.     | 2011 | Italy   |
| Sameer et al.         | 2012 | India   |
| Catania et al.        | 2012 | Italy   |
| Chou et al.           | 2012 | Grenada |
| Gallagher and Hartnick| 2012 | USA     |
| Agarwal and Kanekar   | 2012 | USA     |
| Author                        | Year | Country        |
|-------------------------------|------|----------------|
| Goins and Beasley\(^{12}\)   | 2012 | USA            |
| Kim and Chung\(^{13}\)       | 2012 | South Korea    |
| Bando et al.\(^{14}\)        | 2012 | Japan          |
| Altay et al.\(^{15}\)        | 2012 | Turkey         |
| LaRiviere and Waldhausen\(^{16}\) | 2012 | USA            |
| Edwards et al.\(^{17}\)      | 2013 | USA            |
| Pfeiffer et al.\(^{18}\)     | 2013 | USA            |
| Choi et al.\(^{19}\)         | 2013 | South Korea    |
| Safiruddin et al.\(^{20}\)   | 2014 | The Netherlands|
| Curtis and Edwards\(^{21}\)  | 2014 | USA            |
| Zander and Smoker\(^{22}\)   | 2014 | USA            |
| Gaddikeri et al.\(^{23}\)    | 2014 | USA            |
| Carter et al.\(^{24}\)       | 2014 | USA            |
| Kim\(^{25}\)                 | 2014 | South Korea    |
| Rohof et al.\(^{26}\)        | 2014 | The Netherlands|
| Oomen et al.\(^{2}\)         | 2015 | The Netherlands|
| Ibrahim et al.\(^{27}\)      | 2015 | USA            |
| Huang et al.\(^{28}\)        | 2015 | China          |
| Hills and Maddalozzo\(^{29}\)| 2015 | USA            |
| LaPlante et al.\(^{30}\)     | 2015 | USA            |
| Gioacchini et al.\(^{31}\)   | 2015 | Italy          |
| Chala et al.\(^{32}\)        | 2015 | Spain          |
| Hong et al.\(^{33}\)         | 2015 | South Korea    |
| Shah et al.\(^{34}\)         | 2015 | USA            |
| Bakkar et al.\(^{35}\)       | 2016 | Italy          |
| Ho et al.\(^{36}\)           | 2016 | USA            |
| Brown and Harave\(^{37}\)    | 2016 | UK             |
| Christison-Lagay\(^{38}\)    | 2016 | USA            |
| Sturniolo et al.\(^{39}\)    | 2016 | Italy          |
| Thompson\(^{40}\)            | 2017 | USA            |
| Nightingale\(^{41}\)         | 2017 | Australia      |
| Thompson et al.\(^{42}\)     | 2017 | USA            |
| Frank et al.\(^{43}\)        | 2017 | USA            |
| Rayess et al.\(^{44}\)       | 2017 | USA            |
| Alatsakis et al.\(^{45}\)    | 2018 | Greece         |
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Results

Epidemiology
Thyroglossal duct cyst (TDC) is the most common congenital malformation of the neck, representing 70% of all congenital cervical lesions, and despite of being the most common pediatric cervical mass, it also occurs in the adult population, with variable frequency. Studies have indicated that the overall mean prevalence of TDC in the population is 7%, being found in approximately 5-10% of the autopsy examinations performed; most cases remain asymptomatic until diagnosis\textsuperscript{30,31}. Gender prevalence is approximately the same; however, diagnosis tends to be predominant in male pediatric patients and female adult patients. There is no ethnic or geographic preference. Two-thirds of the patients with TDC are diagnosed before the age of 30, and over 50% of these can be clinically observed before age 10, and are usually diagnosed at the mean age of five years\textsuperscript{1,47}.

Brazilian panorama
In Brazil, there were 23,602 hospitalizations for TDC excision between January 2008 and December 2018, with an average of 2,145 procedures performed per year; with the largest number of procedures performed in 2008 (2,703) and the lowest in 2016 (1,735), according to the SIH-DataSUS (Figure 2). Considering the growth of the Brazilian population for this period (2008-2018), according to data from the Brazilian Institute of Geography and Statistics (IBGE)\textsuperscript{51}, there was a constant annual growth rate close to 0.9%, thus, the average number of TDC excision was 11.85 per 100,000 inhabitants in the period evaluated.

Distribution of this procedure in Brazil from 2008 to 2018 showed predominance in the Southeast, Northeast and South regions, which together accounted for 87% of the total hospitalizations. The Southeast region concentrated the largest number of performed procedures (8,761), 37% of the total for the country in the period, with an annual average of 796 surgeries, followed by the Northeast region with 8,358 procedures, 35%, the South and North regions with 3491 and 1811 procedures, 15% and 8%, and the Midwest region with 1,181 surgeries, with an annual average of 107 procedures, 5%. The state of São Paulo presented the largest number of performed procedures during the period under analysis (4,786), with an annual average of 435, whereas

Table 1. Continued...

| Author                | Year | Country  |
|-----------------------|------|----------|
| Bansal et al.\textsuperscript{46} | 2018 | USA      |
| Quintanilla-Dieck and Penn\textsuperscript{47} | 2018 | USA      |
| Patel and Bhatt\textsuperscript{48} | 2019 | USA      |
| Hosokawa et al.\textsuperscript{49} | 2019 | Japan    |
| Amos and Shermetaro\textsuperscript{1} | 2019 | USA      |
| Korbi et al.\textsuperscript{50} | 2019 | Tunisia  |
The state of Amapá showed the smallest number of performed procedures (75) in the period, with an annual average of seven surgeries. The total cost for the Brazilian Unified Health System (SUS) with TDC excision in the period was BRL 11,604,754.30, with an annual average of BRL 1,054,977.66. The individual average value of each hospitalization was BRL 491.68. The average hospital length of stay for the procedure was 1.5 days. In the period described, there were 10 deaths resulting from the procedure, four of them in 2008 alone, with subsequent 1 to 2 deaths per year between 2009 and 2016, resulting in a mortality rate of 0.04% (Table 2).

### Table 2. Brazilian Panorama - TDC excisions performed by the SUS between 2008 and 2018.

| Total Number of Surgeries       | 23,602          |
|---------------------------------|-----------------|
| Annual Average Number of Surgeries | 2,145           |
| Procedures/100,000 inhabitants  | 11.85           |
| Annual Cost (BRL)               | 1,054,977.66    |
| Individual Average Value (BRL)  | 491.68          |
| Average Hospital Length of Stay (days) | 1.5        |
| Mortality Rate (%)              | 0.04% (8 deaths) |
| Most Prevalent Region           | Southeast (37%) |
| Least Prevalent Region          | Midwest (5%)    |

**Figure 2.** Total number of TDC excisions in Brazil from 2008 to 2018.

**Literature analysis on TDC diagnosis**

Analysis of the reviews published in the past decade reaffirms the importance of embryological knowledge for the proper diagnosis of thyroglossal duct cyst (TDC). Formation of TDC is due to persistence of the thyroglossal duct after the end of the descent of the thyroid gland, which originates from the base of the tongue, in the passing inside the hyoid bone, until is positioned...
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The literature indicates that the TDC is most frequently located under the hyoid bone (approximately 65% of cases). Suprahyoid TDCs are usually located in the midline, whereas infrahyoid TDCs are located in the paramedian region. In some cases, there are areas of remnant thyroid tissue associated with malformation. There are cases of TDC carcinoma, with papillary carcinoma as the most frequent histological type, corresponding to 80% of the reported cases, followed by the follicular type, but prevalence of TDC-associated carcinoma is less than 1%. Up to one third of patients present a history of recurrent cyst infections, with *Haemophilus influenzae*, *Staphylococcus aureus*, and *Staphylococcus epidermidis* as the most common pathogens. In up to a quarter of the cases, cervical fistula with drainage of cyst contents may occur.

The most recommended complementary examinations reported in the literature are cervical ultrasound (US) scan and thyroid stimulating hormone (TSH) test, which are important mainly to rule out ectopic thyroid tissue.
because, although only 10% of ectopic thyroid cases are found in the neck, it can represent the only thyroid tissue in 75% of patients. The US scan shows a well-defined, internally anechoic cyst representing cystic content. If atypical manifestations such as calcifications, thick walls, internally isoechoic/hyperechoic nodules, or prominent adjacent vascularization are observed, additional imaging studies such as using computed tomography (CT) or magnetic resonance imaging (MRI) are required. CT will show a simple thin-walled hypoattenuating mass, whereas in MRI, the lesion will have a high T2 signal and a low-to-intermediate signal in T1-weighted images.

Differential diagnosis of cervical malformations involve an array of diseases affecting the midline region, and the following congenital malformations are among the most important pointed out in the literature: ectopic thyroid tissue, branchial cleft cyst, dermoid cyst, thymic cyst, laryngocele, and lymphatic malformations. For differential diagnosis, attention should be focused on the adjacent structures and the internal architecture of the lesion during the imaging examination. The main points to differentiate between lesions are described ahead.

Gill cysts are usually located along the anteromedial border of the sternocleidomastoid muscle, lateral to the carotid space and posterior to the margin of the submandibular gland. On imaging, there may be a “beak” sign characterizing the curved edge of the lesion that extends between the internal and external carotid arteries.

Dermoid cysts are located in subcutaneous tissues, superficial to the musculature, usually near the suprasternal notch. The image may show calcifications or fat inside the cyst.

Thymic cysts are closely associated with the carotid sheath, sometimes affecting the carotid artery and the jugular vein. On imaging, they present dumbbell or bilobed appearance, and may extend to the anterior mediastinum.

Laryngocele has the main characteristic of being full of air or with fluid and air levels due to communication with the airways.

Lymphatic malformations or head and neck lymphangiomas present fluid levels, usually from recent hemorrhage associated with transseptal lesions.

**Literature analysis on TDC treatment**

The literature indicates a surgical procedure known as the Sistrunk procedure, either classical or modified, is the standard treatment for TDC. Previously, high recurrence rates were observed after isolated cyst excision. In 1920, Sistrunk recommended block removal of tissue from the base of the tongue involving the entire duct, the cyst, and part of the hyoid bone. With this technique, the current recurrence rate is approximately 3%. The main surgical objectives are to prevent cyst infection, avoid the rare possibility of neoplastic transformation, and for aesthetic purposes. The literature recommends that infected cysts should be initially treated with antibiotic therapy before the surgical procedure. Draining of infected cysts should be avoided if possible in order to prevent the spread of ductal cells out of the cyst, which may increase the risk of cyst recurrence after surgery. Local seroma formation...
and wound infections were the two most frequently observed complications in historical series; other complications such as hematoma, salivary fistula, hypothyroidism and airway stenosis have been rarely reported. 

**Discussion**

The Brazilian panorama for thyroglossal duct cyst (TDC) shows that there is an annual prevalence of this condition operated by the public health network at almost constant levels and with relevant costs. The numbers for the investigated period indicate a prevalence higher than that reported in the international literature, considering that the national number of TDC excisions of the order of 11.85/100,000 inhabitants compared with those of some world series, which show an average of 2.2/100,000 inhabitants. 

The largest number of procedures performed in the Southeast region indicate the concentration of health services as well as of the population in this region; however, it is worth noting that TDC excision is performed throughout the national territory by the public health system, which shows a maintenance this pathology, distributed nationwide, and alerts for the importance of knowing the appropriate diagnosis and therapy.

The literature is emphatic in mentioning that knowledge on the embryology of TDC is an important factor for the establishment of good propaedeutic, because malformations in the structures that form the cervical region are diverse and present confluent clinical practice. The clinical practice for TDC is well defined, and US scan, which is the standard for the initial evaluation, is widespread throughout the country, enabling more assertive diagnosis. However, situations such as recurrent infections, ectopic thyroid, and lymphatic malformations should be considered at the time of diagnosis because of their high prevalence, as well as the aforementioned differential diagnosis.

The recommended treatment for TDC is almost unanimous in the literature due to its efficacy and low complication rates and, mainly, to its low recurrence rates. The Sistrunk procedure has already been pointed out by metanalysis as the method of choice for the treatment of TDC. Alternative methods have been proposed, such as sclerotherapy with intracystic application of the OK-432 sclerosing agent, produced by lyophilization of the low virulent Su strain of *Streptococcus pyogenes*; as well as the use of ethanol, aiming at necrosis and later coagulation and cyst thrombosis, both discretely disseminated in medical practice, and thus with no data available for analysis. 

Limitations to this epidemiological study include the non-systematization and separation by SIH/DataSUS between sex and age groups of patients undergoing the procedures performed, as well as anatomical data regarding the topography of the affected cervical region and the number of post-surgery complications. This is a retrospective study conducted with secondary data in which patients were not randomized or compared. Another possible limitation is the data coding inaccuracies, as they were collected from the national public database, which depends on the information provided and may be underreported. The analysis of the reviews published in the past decade contributes to the outline of the diagnosis and management of TDC treatment overall; however, the analysis of the reviews presents methodological limitations because, ultimately, the references included will be narrative reviews and not of data, which reduces the strength of the analysis of evidence.
Conclusions

The Brazilian panorama of thyroglossal duct cyst (TDC) management shows that this is a prevalent disease, with approximately constant rates during the period evaluated, with relevant annual costs to the SUS, and the Southeast region of the country as the main source of treatment for this condition. Assessment of anterior neck masses requires knowledge on the embryology of thyroid development for recognition of thyroglossal duct anomalies, just as it determines the anatomical relationships that establish the knowledge for differentiation from other cervical masses, along with imaging examinations such as US scan. Surgical treatment of TDC using the Sistrunk procedure is considered the method of choice, presenting small number of complications and low recurrence rates.

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