Differentiation of cystic lesions of neck

Lalita Yunusova\textsuperscript{1),} Toru Aoyama\textsuperscript{2),} Yulduz Khodjibekova\textsuperscript{1),} Sobirjon Mamarajabov\textsuperscript{1),} Adkham Khasanov\textsuperscript{1),} Junichi Sakamoto\textsuperscript{3),} Elmira Baykhodjaeva\textsuperscript{1)

\textsuperscript{1) Tashkent state dental institute, Samarkand state medical institute,}
\textsuperscript{2) Department of Surgery, Yokohama City University,}
\textsuperscript{3) Tokai Central Hospital

Abstract

Cystic masses of the neck are relatively frequent developmental defects. Surgery is the only effective treatment. Early intervention is usually recommended to avoid complications. These three signs: the presence of internal septae, irregular walls and a solid component were combined into an assessment SIST SCORE (septae + irregular wall + solid components = TGDC SCORE). This study was also undertaken to assess the possible application of ultrasound in the differentiation of cysts of the neck.

Keywords: Cystic swelling; Neck; Ultrasonography; Dermoid cysts; Thyroglossal cysts; Lateral cysts of the neck.

(Received September 10, 2020; Accepted October 12, 2020)

Introduction

Cystic lesions of the neck are relatively frequent malformations. Surgery is the only effective method of treatment, and early intervention is usually recommended to avoid complications. In children, median (congenital) cystic neoplasms are more common. The most common of these are thyroglossal (TGC) (Fig. 1) and dermoid cysts (DC) (Fig. 2)\textsuperscript{1,2).} The development of thyroglossal cysts of the neck is associated with the non-dissection of the thyrolingual duct (ductus thyreoglossus), which results in the accumulation of secretions in the remaining cavity and the formation of cysts. Dermoid cysts develop from embryonic slits formed by pleats of ectodera that are dislocated during embryonic development of the embryonic recesses. Thyroglossal cysts tend to be related more closely to the hyoid bone, while dermoid cysts can be located in the chin area, or over the area of the sternum. Lateral cysts of the neck have a branchiogenic genesis, which means they can develop from non-obliterated residues of gill recesses\textsuperscript{3).} There are still disagreements regarding the pathogenesis of lateral cysts and fistulas. There are two theories of their origin. According to the “thymus” theory, these cysts and fistulae form from the remnants of the thyropharyngeal duct. The “branchiogenic” theory connects the origin of these masses with the anomalous development of the gill recesses. The anomalous development of the 2nd or 3rd pair of pharyngeal (gill) recesses is the source of the formation of lateral cysts and fistula of the neck. The inner branchiogenic recesses are formed by endodermal, while the outer branchiogenic recesses (or grooves) are formed by the ectodermal germ layer. Lateral cysts of the neck can be of both endodermal and ectodermal in origin\textsuperscript{4,5).} Knowledge of the embryology, anatomy, and clinical presentation currently helps the surgeon to determine the clinical diagnosis. Pre-operative imaging, especially ultrasound, has become the “gold” standard for confirming cystic formations and their location. Until recently, ultrasound could not accurately differentiate between TGC and DC, especially considering the potentially similar appearance on ultrasound images. Subsequently, three ultrasound signs were described, which allows the physician to more accurately predict whether the cystic formation of the midline of the neck is TGC or DC\textsuperscript{4,5,6).} These three signs: the presence of internal septum, irregular walls and a solid component were combined into a SIST SCORE estimation (septae + irregular wall + solid components = TGDC SCORE) according to Oyewumi et al. (2015)\textsuperscript{7).} This study was also undertaken to assess the possible application of ultrasound in the differentiation of cervical cysts.

Material and methods

Fifty-six patients with cystic neoplasms were eligible for the present study. The studies were carried
out using SLE-501 (Lithuania) and Affiniti-70 (Philips, Holland) devices with linear sensors of 7.5 and 12 MHz. Sonography was performed with the patient in a horizontal position with a slightly upturned head. From the suprahypoid region (SHR), the scan was performed in the frontal plane with a gradual tilting of the posterior sensor to visualize the tissues of the submental region (SMR), the floor of the mouth (FM), the body and the root of the tongue (RT), and the hyoid bone (HB). Ultrasound scanning with the sensor in this position makes it possible to obtain an image that is convenient for the comparison of the symmetrical anatomical structures of the tissues in the studied area. After this, the same access was used to scan in the sagittal plane to obtain an image of the body tissues, RT, FM, the suprahypoid region and HB (as the most important anatomical landmark). Then scanning was carried out in the horizontal and sagittal planes of the entire subhyoid region—from the HB to the jugular fossa, including thyroid gland (thyroid gland). When changes were detected, the scanning plane was chosen arbitrarily to obtain the most complete information about the region of interest. The control group consisted of 20 people with no signs of pathological conditions of the neck. In cystic neoplasms, sonography was used to evaluate the localization of a mass, its size, contours, internal echogenicity, the presence of septa (partitions), the presence of an artefact of distal acoustic amplification and blood flow during color Doppler mapping. Compression of the formation of an ultrasonic sensor allows differential diagnostic tests to be performed and for the true nature of the cyst to be confirmed.

**Results**

Fifty-six patients with cystic neoplasms (mean age, 12 ± 2 years [range 1 to 52 years]; female, n = 32 [57.1%]; males, n = 24 [42.9%]). Among these patients, based on a comprehensive survey, including surgical findings, 22 examined patients had thyroglossal cysts of the neck, 14 had dermoid cysts of the neck, and 19 had lateral cysts of the neck. Thyroglossal cysts were the most prevalent cystic formation of the neck. The duration (from the moment of detection of a cyst to operation) differed: up to 6 months in 28 (50%) patients; from 6 months to 1 year in 16 (28.6%) patients; and more than 1 year in 12 (21.4%) patients. In 12 (21.4%) patients with cysts of neck, the diagnosis was made in the suppuration stage. Nineteen patients were examined after previous surgery (dissection of suppurative cysts, n = 10; cyst removal, n = 7; cyst removal with fistula of the neck, n = 2). Sonography was used to diagnose cystic neoplasms in the pre-operative period (n = 56), and to assess the monitoring of recurrent cystic neoplasms (n = 6). From the 56 examined patients, 21 were diagnosed with thyroglossal cysts of the neck, 1 patient was diagnosed with carcinoma of the thyroid gland, 19 were diagnosed with lateral cysts (branchial cysts: type I, n = 5; type II, n = 10; type III, n = 4) and 1 patient was diagnosed with branchiogenic cancer.

In cystic lesions, sonography was used to evaluate the localization of a mass, its size, contours, internal echogenicity, the presence of septa (partitions), the presence of artefacts of distal acoustic amplification, blood flow during color Doppler mapping. Compression of the lesion with an ultrasonic sensor differential diagnostics to be confirmed and the true nature of the cyst to be confirmed. The main reliable signs were septa in the structure, a solid component, and irregular contours, which echoes the
confirmed findings about the nature of thyroglossal cysts. The localization was as follows: over the hyoid bone \( (n = 7 \ [19.4\%]) \), at the level of the hyoid bone \( (n = 11 \ [30.5\%]) \), and lower than the hyoid bone \( (n = 4 \ [11.1\%]) \). Dermoid cysts were located in the middle chin-lingual region in 5 (13.9%) patients and the chin-sublingual region in 9 (25%) patients. Among the 22 patients (61.1%) all three signs of a thyroglossal cyst were detected by echo scanning in 10 (27.8%) patients. Septa in the structure and irregular contours were observed in 3 (8.4%) patients. In the remaining 5 (13.9%) patients, the signs listed above were not identified. They appeared like a small rounded hypoechoic mass, of homogeneous structure, with clear, smooth contours. During ultrasonography, dermoid cysts looked hypoechoic, with hyperechoic and anechoic inclusions in the structure. Round forms were observed in 9 patients (25%), with an irregular shape with smooth and clear contours in 5 (13.9%) patients. In 29 (80.5%) patients with midline cystic formations, a distal acoustic amplification artifact was noted. The average size of the thyroglossal cysts was 1.60 ± 0.50 cm, while the average size of the dermoid cysts was 1.60 ± 0.50 cm. The average thickness of the walls of cystic neck (thyroglossal) formations was 0.23 ± 0.17 cm, while that in dermoid cysts was 0.18 ± 0.10 cm. In 2 (5.5%) patients with thyroglossal cysts, external fistulas were detected, which were also confirmed by fistulography. During Doppler scanning in 2 patients, increased blood flow was detected in the structure of the solid component; during histological verification, this was diagnosed as thyroid carcinoma metastasis and branchiogenic cancer, which imitated the imaging findings of thyroglossal and branchiogenic cysts (Fig. 3).

**Discussions**

First analysis showed that there were 14 dermoid cysts. The number of nosological forms did not differ according to sex. A comparative analysis of the frequency of signs detected by ultrasound in thyroglossal, dermoid and lateral neck cysts is presented in the table. As can be seen from the presented table, thyroglossal cysts are characterized by localization in the region of the hyoid bone or near the hyoid bone (higher or lower), while dermoid cysts are localized in the middle chordo-lingual, or chin-hyoid regions. Lateral type I cysts were located superficially, deeper than the superficial muscle of the neck, anterior to the sternocleidomastoid (SCM) muscle. Type II cysts were adjacent to the internal carotid artery, tightly adjacent to the internal jugular vein, and type III cysts were located between the internal and external carotid arteries.

Second analysis showed that we identified the following clinical features of the lateral cysts of the neck in adults: 1. a long asymptomatic course, 2. often manifests itself clinically for the first time only with inflammation, 3. atypical localization of the mass, 4. recurrence is possible after surgical treatment. Lateral cysts on ultrasonography are visualized in the form of cystic formations of oval or rounded shape, with smooth clear contours. According to A.A. Timofeev et al. (2016) there are four types of echogenicity of lateral cysts: anechoic (found in 41%), mostly uniformly hypoechoic with a low amplitude free-floating suspension (debris) (diagnosed in 24%); hyperechoic with “pseudo-solidarity” (12%); and heterogeneous content with a suspension and septa (in 23%). The type of echogenicity is affected by the consistency of the contents of the lateral cyst, which can vary depending on the presence of the inflammatory process (liquid cystic, liquid cystic with suspension, pasty, festerings). “Pseudosolidarity” is explained by the presence of protein in the cyst produced by the epithelial lining. In color Doppler mapping (CDM), energy mapping, and spectral doppler sonography, the cysts are avascular. The shell of the cyst has the form of a hyper-echogenic or iso-echogenic linear border structure, which is often avascular in the CDM. The thickness of the shell can vary in different parts of the cyst and reach up to 1.0 cm with repeated inflammation; however, its thinning is also possible, which makes the shell undifferentiable. In our studies, branchiogenic cysts of the neck in the acute stage on the echogram were visualized as a cystic formation with an oval shape, smooth contours, clear boundaries, with hypoechoic content, and a small number of isoechoic inclusions in 11 (19.6%) patients. In 5 (8.9%) cases, an iso-echogenic area of wall thickening, edema, and decreased echogenicity of the subcutaneous tissue...
and spermus muscle were observed, indicating the inflammatory process of cystic neck formation, were noted at the lower pole of the formation. In 3 (5.3%) patients, a festering multi-chamber lateral cyst of the neck was recorded on the echogram as a cystic formation, with the presence of isoechoic septa. Anechoic cyst contents acoustic artifact of amplification distal to the cyst. In 2 patients, the echogram visualized a cystic formation of an oval shape with smooth contours, filled with heterogeneous contents with a suspension, the “pseudosolidity” effect. In 5 (8.9%) cases, the cyst was adjacent to the internal jugular vein, which compressed the jugular vein as well as the external (ECA) and internal carotid arteries (ICA). The artifact of acoustic amplification was observed distal to the cyst. There was no blood flow inside the formation. In 1 patient a Doppler scan revealed increased blood flow in the structure of the solid component, and histological cancer was diagnosed when performing histological verification.

Conclusion

The clinical presentation and imaging features, including the anatomical location, extent, internal composition, and vascularity, as assessed by Doppler ultrasound are helpful in making an accurate diagnosis of cystic lesions of the neck. Radical resection of cysts is a definitive treatment that prevents recurrence.

Acknowledgments:

This study is supported, in part, by the nonprofit organization Epidemiological and Clinical Research Information Network (ECRIN).

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Table 1 Echographic signs and their frequency in cystic lesions of the neck.

| Echographic signs                  | Thyroglossal cysts (n = 21) | Dermoid and epidermoid cysts (n = 14) | Branchiogenic cysts (n = 20) |
|------------------------------------|----------------------------|--------------------------------------|----------------------------|
| Localization                      | I – above hyoid bone, n = 7 (33.3%) | I- chin-lingual area, n = 5 (35.7%) | I – superficially, deeper than the superficial muscle of the neck, anterior to the sternocleidomastoid (SCM) muscle, n = 5 (25%) |
|                                   | II – on the level of the hyoid bone, n = 11 (52.3%) | II- chin-hyoid area - 9 (64.3%) | II – adjacent to the internal carotid artery, tightly adjacent to the internal jugular vein, n = 10 (50%) |
|                                   | III – lower hyoid bone, n = 4 (19%) |                           | III – located between the internal and external carotid arteries, n = 5 (25%) |
| Sizes (max. diameter)             | 1.6 ± 0.5 cm (1.5-2.2)      | 1.6 ± 0.5 cm (1.5-2.2)             | 2.5 ± 0.8 cm (1.2-8.0)    |
| Contours                          | Smooth, clear               | Smooth, clear                       | Smooth, clear               |
|                                   | Rough, fuzzy                | Rough, fuzzy                        | Rough, fuzzy                |
|                                   | 6 (27.2%)                   | 9 (64.3%)                           | 9 (55.0%)                   |
|                                   | 16 (72.8%)                  | 5 (35.7%)                           | 9 (45.0%)                   |
| Shape                             | Awry                        | Round                               | Round                       |
|                                   | 15 (71.5%)                  | 5 (35.7%)                           | 9 (45.0%)                   |
|                                   | Rounded                     | 9 (64.3%)                           | 11 (55.0%)                  |
| Internal structure:               | Homogeneous                 | Homogeneous                         | Homogeneous                 |
|                                   | 6 (28.5%)                   | 14 (100%)                           | 9 (45.0%)                   |
|                                   | heterogeneous               | 15 (71.5%)                          | 11 (55.0%)                  |
| Echogenicity:                     | anechoic                    | anechoic                            | anechoic                    |
|                                   | 6 (28.5%)                   | 2 (14.2%)                           | 11 (55.0%)                  |
|                                   | iso-echogenic               | 13 (59%)                            | 11 (55.0%)                  |
|                                   | hyperechoic                 | 3 (13.6%)                           | 9 (45.0%)                   |
| The presence of internal septae   | 3 (14.3%)                   | -                                   | 3 (15.0%)                   |
| Distal acoustic amplification     | 21 (100%)                   | 14 (100%)                           | 17 (85%)                    |