Cystic lesions of the neck by computed tomography: iconographic essay of differential diagnosis

Poster No.: C-1642
Congress: ECR 2017
Type: Educational Exhibit
Authors: L. D. P. G. D. Farias¹, I. G. Padilha², M. L. L. Soares³, M. A. Cardoso³, D. T. Rosa³, F. M. N. R. Arraes³, C. J. J. D. Santos³, C. M. N. R. D. Miranda³, ¹São Paulo, SP/BR, ²São Paulo/BR, ³Maceió/BR
Keywords: Education and training, Cysts, Congenital, Education, CT-High Resolution, Soft tissues / Skin, Head and neck, Anatomy
DOI: 10.1594/ecr2017/C-1642

Any information contained in this pdf file is automatically generated from digital material submitted to EPOS by third parties in the form of scientific presentations. References to any names, marks, products, or services of third parties or hypertext links to third-party sites or information are provided solely as a convenience to you and do not in any way constitute or imply ECR's endorsement, sponsorship or recommendation of the third party, information, product or service. ECR is not responsible for the content of these pages and does not make any representations regarding the content or accuracy of material in this file.

As per copyright regulations, any unauthorised use of the material or parts thereof as well as commercial reproduction or multiple distribution by any traditional or electronically based reproduction/publication method is strictly prohibited.

You agree to defend, indemnify, and hold ECR harmless from and against any and all claims, damages, costs, and expenses, including attorneys' fees, arising from or related to your use of these pages.

Please note: Links to movies, ppt slideshows and any other multimedia files are not available in the pdf version of presentations.

www.myESR.org
Learning objectives

The purpose of this essay is to:

- Review structural imaging abnormalities on computed tomography (CT);
- Correlate important findings of most common cystic and cystic like lesions of the neck with their clinical, anatomy, pathogenesis and embryologic origin;
- Emphasize the most important radiologic features on CT;

Background

Cyst is an well circumscribed epithelial lined cavity, usually filled with fluid.

Cystic lesions of neck include a wide range of congenital, frequently encountered during infancy/childhood, and acquired lesions. The latter group various inflammatory, neoplastic, vascular and traumatic diseases, the majority of cystic or cyst-like neck lesions in adults. Congenital cervical cystic lesions are usually slow-growing and typically cause symptoms only due to enlargement or infections associated.

Clinical history and physical examination of the patient are the most important factors in the evaluation of a neck lesion. Familiarity with the embryology and anatomy of the cervical region frequently allows the differential diagnosis to be narrowed. Although clinical history and examination may suggest the diagnosis, imaging is required to confirm the clinical diagnosis and assess the anatomical extent of involvement before the treatment planning.

CT determines the attenuation coefficient, detect calcifications and allows to evaluate the location, as well as its relation to adjacent structures, and enhancement pattern, discerning them from solid lesions. Although there are overlapping features, differentiation between the lesions can usually be made based on specific imaging findings and relevant clinical information.

Cystic or cystic-like lesions of neck mimic a diversity of radiologic entities. The differential diagnosis includes:

Cystic lesions:

- Thyroglossal duct cysts;
- Branchial cleft anomalies;
• Venolymphatic malformations;
• Dermoid/epidermoid cysts;
• Thymic cysts;
• Laryngocele;
• Cervical bronchogenic cysts;
• Ranulas;

Cystic-like lesions:

• Cystic metastatic lymph node;
• Neurogenic tumors;
• Vascular;
• Infections/inflammatory lesions;
• Cystic lesions of salivary glands;
• Cystic lesions of thyroid;

Findings and procedure details

The evaluation of a patient suspected of having a neck cystic lesion should follow an orderly progression:

• The clinical history and physical examination of the patient are the most important factors.
• Ultrasonography (US): an ideal initial imaging investigation for neck lesions as it reveals the cystic nature in most cases and localizes the lesion in relationship to the surrounding structures. Development of three-dimensional technology, color, and power Doppler applications has led to great improvement in its diagnostic utility.
• Computed tomography (CT): also provides and confirms the findings of US. It is ideally suited for evaluation of soft-tissue planes adjacent to larger lesions that cannot be entirely visualized with US. In addition, it determines the extent of lesion, and is especially useful in demonstration of calcification or fat within the lesion, and enhancement when contrast material is administered (discerning them from solid lesions).
• Magnetic resonance imaging (MRI): supplementary role in work-up of cystic neck lesions. Its multi-planar capability and superior contrast resolution demonstrates the full extent of the lesion and gives important supplemental anatomical information for accurate preoperative planning, particularly for more deep-seated and locally extensive lesions (in cases of extension into the mediastinum or deep spaces of the neck). Furthermore, MRI offer superior resolution for evaluating lesions located in anatomically complex areas, such as the floor of the mouth.
We have conducted a retrospective analysis of a selected series of patients with cystic/cystic-like cervical lesions. An additional review of the current literature was also conducted to identify the most relevant CT aspects in order to identify specific imaging features to narrow the differential diagnosis.

**THYROGLOSSAL DUCT CYSTS**

Thyroglossal duct cyst (TDC) is the most common midline congenital neck lesion accounting for 70% of the congenital neck anomalies. The cyst occurs along the residual tract left by the thyroid gland after descent from the foramen cecum at the tongue base to its final position in the visceral space.

On CT scans, a thyroglossal duct cyst usually appears as a smooth, well-circumscribed lesion anywhere along the vertical course of the vestigial thyroglossal duct (Fig. 1 on page 10). It has a thin wall and homogeneous attenuation, the values of which correspond to those of fluid (10-18 HU). Elevated attenuation values of the fluid cyst reflect its increased protein content and generally correlate with a history of prior infections (Fig. 2 on page 10). Although thyroglossal duct cysts are usually unilocular, septations may be seen occasionally. Peripheral rim enhancement is usually observed on contrast-enhanced scans.

The cyst is located:

- At the level of hyoid bone (15-50%);
- Infrahynoid location (25-65%);
- Suprahyoid location (20-25%).

The more inferior the cyst, the more likely it is to be off the midline.

In adults, thyroid carcinoma can develop into a TDC, with an incidence of 1%, mostly the papillary subtype. Presence of solid soft tissue elements, often nodular, within a thyroglossal cyst is highly suspicious of malignancy (Fig. 3 on page 10). Calcification within the cyst is thought to be a specific finding of carcinoma within TDC.

**BRANCHIAL CLEFT ANOMALIES**

Branchial cleft anomalies arise from incomplete obliteration of any branchial tract, resulting in either a cyst (75%) or a sinus or fistulous tract (25%). Patients with branchial cleft cysts are usually older children or young adults, in contrast to patients with fistulae, who are usually infants or young children.

Second branchial anomalies comprise 95% of all branchial cleft lesions, most commonly presenting as cystic lesions rather than sinuses or fistulas. On CT, it is seen as a
well-circumscribed, homogeneously hypodense lesions surrounded by a uniformly thin wall. Occasionally, a beak sign (sometimes referred to as the notch sign or tail sign) may be seen as a curved rim of the lesion pointing medially between the internal and external carotid (long-established as pathognomonic, is still highly suggestive of the diagnosis). The "classic" location of these cysts is at the anteromedial border of the sternocleidomastoid muscle, lateral to the carotid space and at the posterior margin of the submandibular gland (Fig. 4 on page 11, Fig. 5 on page 12).

Bailey has classified second branchial cleft cysts into four types:

- Type I: anterior to the sternocleidomastoid muscle just deep to the platysma muscle;
- Type II: deep to the sternocleidomastoid and lateral to the carotid space. It is the commonest type;
- Type III: it extends medially between the bifurcation of internal and external carotid arteries to the lateral pharyngeal wall;
- Type IV: in the pharyngeal mucosal space medial to the carotid sheath.

A first branchial cleft cyst, or parotid lymphoepithelial cyst, arises along the residual embryologic tract of the first branchial cleft or arch extending from the external auditory canal through the parotid gland to submandibular triangle. On CT, it appears as a cystic lesion either within, superficial to, or deep to the parotid gland.

Third and fourth branchial cleft anomalies are exceedingly rare and typically present with a long history of neck infections. Both are related to the pyriform sinus with those of the third cleft being above the superior laryngeal nerve and those of the fourth being below the nerve. Third BCCs are located in the posterior cervical space posterior to the common or internal carotid artery and the sternocleidomastoid muscle. Fourth branchial cleft anomalies are generally sinus tracts or fistulae and arise from the pyriform sinus, pierce the thyrohyoid membrane, and descend along the tracheoesophageal groove.

**VENOLYMPHATIC MALFORMATIONS (LYMPHANGIOMA)**

Venolymphatic malformations are congenital abnormalities that arise when developing lymphatics fail to establish communication with developing veins (Fig. 6 on page 12, Fig. 7 on page 13), most commonly developing along the jugular chain.

A cystic higroma is the most common form lymphangioma and constitutes about 5% of all benign tumors of infancy and childhood. Approximately 75-80% of all cystic hygromas involve the neck and the lower portion of the face, usually centered in the posterior triangle or the sub#mandibular space. These lesion are characteristically infiltrative in nature and do not respect fascial planes (this relationship is best demonstrated with MRI). On CT,
it shows as poorly circumscribed, multi-loculated, hypodense lesions, fluid attenuation (Fig. 8 on page 13). Sudden enlargement may occur due to hemorrhage or infection (higher density lesions). Hematic content is usually associated to liquid-liquid level.

The modern classification scheme for vascular anomalies was approved by the International Society for the Study of Vascular Anomalies (ISSVA) in 2014.

DERMOID/EPIDERMOID CYSTS

Dermoid cysts and epidermoid cysts compose a spectrum of teratomas (neoplasm which tissue is foreign to that part of the body from which the tumor arises). The essential difference between the lies in the presence of skin appendages within the wall of the dermoid cyst and the absence of these features in the epidermoid cyst.

The most common cervical location of a dermoid cyst is the floor of the mouth. Epidermoid cyst usually appears in the midline neck, suprathyloid, as a slowly growing lesion.

On non-contrast CT, dermoid cyst usually appears as a low-density, unilocular, well-circumscribed lesion. Fat, mixed-density fluid, and calcification (<50%) may also be seen. There may be coalescence of fat into small nodules within the cystic lesion, giving a "sac of marbles" appearance. The presence of calcifications and cystic spaces in these lesions aids in their differentiation from lipomas.

Epidermoid cysts usually show fluid-density material. Post contrast, the lesion wall may be imperceptible or may show subtle rim enhancement. Malignant degeneration into squamous cell carcinoma is seen in up to 5% of lesions.

THYMIC CYSTS

The pathogenesis of cervical thymic cysts remains controversial (congenital or acquired). Some theories associate congenital persistence of the thymopharyngeal duct remnants as the cause of these lesions (oblitration of the lumen of the thymopharyngeal tract occurs during the seventh and eighth week of gestation). Alternatively, other investigators believe that they result from acquired, progressive cystic degeneration of thymic (Hassall) corpuscles and the epithelium reticulum of the thymus.

Thymic cyst is uncommon, with most lesions detected as an incidental imaging finding. On CT, the cyst wall is thin and uniformly smooth, and the cyst content is of mucoid attenuation (10-25 HU). After contrast administration, there is usually a peripheral thin rim of enhancement.
Anatomic location of the thymic cysts occurs anywhere along the thymopharyngeal tract from the hyoid bone to the anterior mediastinum, immediately adjacent to the carotid sheath bordered laterally by the sternocleidomastoid muscles.

**LARYNGOCELE**

A laryngocele is considered to have a congenital derivation, although it usually manifests in adults. It may develop due to an increase of supraglottic pressure (shouting, playing a wind instrument, coughing, etc) in combination of a long laryngeal saccule (a small pouch arising from the roof of the ventricle). When infected it is called laringopiocele.

Laryngoceles are of three types: internal, external, and mixed. Those confined to the larynx are known as internal laryngoceles. Those that extend through the thyrohyoid membrane, but with dilation of only the extra-laryngeal component, are termed external. Most congenital laryngoceles are of the internal type, and patients have symptoms of airway obstruction, feeding difficulties, and a weak cry. Mixed laryngoceles have dilatation of the saccule on both sides of the thyrohyoid membrane.

The association of laryngocele with laryngeal carcinoma is well-documented: Fifteen percent of laryngoceles are associated with carcinoma, with tumor occluding the orifice of the laryngeal ventricle.

On CT, a laryngocele appears as a well-defined, smooth lesion in the lateral aspect of the superior paralaryngeal space. The attenuation of these lesions may vary, depending on the amount of secretions, air, and soft tissue from an associated laryngeal neoplasm. The presence of soft tissue within it suggests an underlying laryngeal neoplasm. Definitive diagnosis of a laryngocele rests with establishing a connection between the air sac and the airway (Fig. 9 on page 14).

**CERVICAL BRONCHOGENIC CYSTS**

Cervical bronchogenic cysts are extremely rare, which result from an anomalous foregut development, but the reason why these cysts reach an aberrant position in the neck remains unclear. They are usually located in the thyroid or para-tracheal region, rarely in the suprasternal or supraclavicular location.

**RANULAS**

Ranula is a mucous retention cyst resulting from obstruction of the sublingual gland or its duct, or rarely the minor salivary glands in the sublingual space. It may be either (1) 'simple' and confined to the sublingual space or (2) 'plunging/diving', which
extend posteriorly into the sub-mandibular space or through a mylohyoid defect (i.e., boutonniere anomaly). Giant ranulas have also been described, which extend into the para-pharyngeal space and have a narrower tail that extends through the sublingual space.

On CT, a simple ranula usually appears as an ovoid-shaped cyst with an homogeneous central attenuation region of 10e20 HU, which lies lateral to the genioglossal muscles and deep to the mylohyoid muscle (Fig. 10 on page 14). When infected it shows a thick, irregular rim of enhancement, with surrounding inflammatory change. A diving ranula often infiltrates adjacent tissue planes, extending inferiorly and dorsally to the submandibular space.

**CYSTIC METASTATIC LYMPH NODE**

Metastatic nodes from head-and-neck malignancy, especially papillary carcinoma of the thyroid, are the most common types of nodal metastases presenting as cystic lesions in the neck (Fig. 11 on page 16). The presence of characteristic punctuate calcifications within the solid component of the cystic node should alert the radiologist towards a careful search for primary papillary carcinoma in the thyroid gland.

Occasionally cystic necrosis within a metastatic lymph node may be very florid, mimicking a congenital cyst, such as a second branchial anomalies. On CT, cystic nodal necrosis appears as focal area of low attenuation with or without a surrounding rim of soft-tissue enhancement (Fig. 12 on page 16).

**NEUROGENIC TUMORS**

Neurogenic tumors are well known in the carotid space and posterior cervical space. The imaging features of these benign lesions include non-infiltrative smooth margins, long-axis fusiform shape and bone remodeling (Fig. 13 on page 17). Characteristically, neurogenic tumors around the carotid sheath are located posterior to the neck vessels.

**VASCULAR**

Rarely vascular lesions may appear as cystic lesions in the neck. Ultrasound supplemented by Doppler ultrasound examination accurately identifies them. They include:

- Aneurysm and pseudoaneurysm (Fig. 14 on page 17);
- Arteriovenous fistula / malformation;
- Venous vascular malformation (when there are lymphatic elements present, then it is known as mixed lymphaticovenous malformation);
• Phlebectasia (dilatation of an isolated vein. The internal jugular vein is the most commonly affected).

INFECTION / INFLAMMATORY LESIONS

Various infections and inflammatory conditions in the neck region manifesting as cyst-like lesions:

• Lymphadenitis (tuberculous lymphadenitis has a predilection for the posterior triangle of the neck and may mimic a cystic metastatic lymph node);
• Abscesses (anywhere in the neck, but common locations are the submandibular, retropharyngeal, and parotid space. An abscess in the submandibular area usually originates from suppurative adenopathy, salivary gland infection, dental abscess, or mandibular osteomyelitis);
• Acute suppurative thyroiditis (rarely acute suppurative thyroiditis and associated abscess are seen especially in children);
• Cellulitis.

On CT, an abscess usually appears as a single or multi-loculated low-density area with rim enhancement. Internal gas collections may be present. The adjacent subcutaneous and fascial fat planes are often obliterated (Fig. 15 on page 18).

CYSTIC LESIONS OF SALIVARY GLANDS

Salivary gland cysts (Fig. 16 on page 18, Fig. 17 on page 18) may be classified into congenital and acquired types:

• Congenital / developmental cysts: lymphoepithelial cysts, branchial cleft anomalies, epidermoid cysts, polycystic disease, congenital sialectasis, and Merkel's cyst. Congenital cysts may be present at birth but do not become evident clinically until adulthood.
• Acquired cysts: sialoceles, pneumoceles, AIDS-related parotid cysts, ranula, and cystic tumors of the salivary gland.

CYSTIC LESIONS OF THYROID

True epithelial thyroid cysts are rare. Most cystic lesions are due to hemorrhage or degeneration within a hyperplastic nodule of multinodular goiter.

On CT, this manifests as a single or multi-loculated low-density area (Fig. 18 on page 19, Fig. 19 on page 19). Papillary carcinomas can have a cystic component that may mimic benign cystic thyroid nodules.
Fig. 1: Thyroglossal duct cyst. Axial (A), coronal (B) and sagittal (C) contrast-enhanced CT scan show a rounded lesion with no significant contrast-enhancement in midline neck. Note the localization in topography of the foramen cecum at the tongue base.

© Clínica de Medicina Nuclear e Radiologia de Maceió (MedRadiUs), Maceió, AL, Brazil.

Fig. 2: Thyroglossal duct cyst. Axial (A), oblique coronal (B) and sagittal (C) contrast-enhanced CT scan show a well circumscribed lesion (yellow arrow) with discrete hyperattenuation (hyperprotein content) in the midline base of the tongue (green arrow) and in close relation with the superior margin of the hyoid bone (red arrow), the path of the thyroglossal duct. Note the rim contrast-enhanced and thin septa in its interior.

© Clínica de Medicina Nuclear e Radiologia de Maceió (MedRadiUs), Maceió, AL, Brazil.
Fig. 3: Complex thyroglossal duct cyst. Sagittal (A), coronal (B) and axial (C) non contrast-enhanced CT scan a complex cystic lesion (yellow arrow) in midline neck, just above of hyoid bone (white arrow). Coronal (D) and axial (E) contrast-enhanced CT scan show soft tissue enhancement following intravenous contrast administration. Presence of solid soft tissue element (green arrow) and calcifications (red arrow) are highly suspicious of malignancy.

© Clínica de Medicina Nuclear e Radiologia de Maceió (MedRadiUs), Maceió, AL, Brazil.
Fig. 4: Second branchial cleft cyst. Axial (A), coronal (B) and sagittal (C) contrast-enhanced CT scan show a spheric and well circumscribed lesion (yellow arrow), fluid density, surrounded by a uniformly thin wall and no contrast-enhanced components. This cyst displace the sternocleidomastoid muscle (green arrow), the submandibular gland (red arrow) and the carotid space (white arrow) - the "classic" location.

© Clínica de Medicina Nuclear e Radiologia de Maceió (MedRadiUs), Maceió, AL, Brazil.

Fig. 5: Second branchial cleft cyst. Axial (A), coronal (B) and sagittal (C) contrast-enhanced CT scan show a spheric cyst, fluid density centrally, surrounded by a uniformly thin wall with a thin septation inside, and no contrast-enhanced components. This cyst displace the sternocleidomastoid muscle, the submandibular gland and the carotid space (the "classic" location).

© Clínica de Medicina Nuclear e Radiologia de Maceió (MedRadiUs), Maceió, AL, Brazil.
**Fig. 6:** Venolymphatic malformation. Axial (A), coronal (B) and sagittal (C) contrast-enhanced CT scan show a multiloculated cystic lesion with rim and septa contrast-enhancement in the right cervical region, deep into the sternocleidomastoid muscle.

© Clínica de Medicina Nuclear e Radiologia de Maceió (MedRadiUs), Maceió, AL, Brazil.

**Fig. 7:** Venolymphatic malformation. Axial (A), coronal (B) and sagittal (C) contrast-enhanced CT scan show a cervical hemangioma.

© Clínica de Medicina Nuclear e Radiologia de Maceió (MedRadiUs), Maceió, AL, Brazil.

**Fig. 8:** Cystic hygroma. Axial (A), coronal (B) and sagittal (C) contrast-enhanced CT scan show a heterogeneous (predominantly cystic) and poorly circumscribed lesion in the right cervicofacial region with peripheral and septal contrast-enhancement. Note that the lesion do not respect facial planes (infiltrative) with superficial and deep components. It begins at the right pterygopalatine fossa and extends to the right clavicular region, without intracranial extension.
**Fig. 9:** Laryngoceles. Axial (A, B) and coronal (C) contrast-enhanced CT scan show bilateral small internal laryngoceles, with air attenuation.

© Clínica de Medicina Nuclear e Radiologia de Maceió (MedRadiUs), Maceió, AL, Brazil.
Fig. 10: Ranula. Sagittal contrast-enhanced CT scan shows a rounded, fluid attenuation and with no contrast-enhancement, in the floor of the mouth.
Fig. 11: Nodal metastasis. Axial (A) and coronal (B) contrast-enhanced CT scan show two contiguous spherical and small lesions (yellow arrow), with similar characteristics, near the expansive formation of the thyroid (red arrow). Note the thrombosis in left internal jugular vein (green arrow).

© Clínica de Medicina Nuclear e Radiologia de Maceió (MedRadiUs), Maceió, AL, Brazil.

Fig. 12: Nodal metastasis. Coronal (A), sagittal (B) and axial (C) contrast-enhanced CT scan show an atypical lymph node enlargement (red arrow), with cystic degeneration, internal septations and peripheral contrast-enhancement adjacent to the left submandibular gland. Note the heterogeneous and expansive lesion with contrast-enhancement on the left lateral wall of the oropharynx (yellow arrow).
Fig. 13: Neurogenic tumor of the first right intercostal branch. Axial (A, B), coronal (C) and sagittal (D) contrast-enhanced CT scan show a regular and well circumscribed lesion with solid contrast-enhanced component associated with cystic areas in the right cervical transition. Note its relation with the paravertebral space (between scalene muscles), the apex of the right lung, the right subclavian artery, the right vertebral artery and remodeling the first rib.

Fig. 14: Aneurysm. 3D volume rendering (A), coronal (B), sagittal (C) and axial (D) contrast-enhanced CT scan show a saccular aneurysm in the cervical portion of the left internal carotid artery.
**Fig. 15:** Abscess. Axial (A), sagittal (B) and coronal (C) contrast-enhanced CT scan show an elongated and thick-walled lesion with rim contrast-enhancement on the topography of the left infra-hyoid musculature that extends to the subcutaneous region. Note that faced to an abscess in the sternocleidomastoid muscle, it should be differentiated from inflammatory processes of the middle ear (Bezold's abscess) and tropical myositis.

**Fig. 16:** Parotid. Axial (A), coronal (B) and sagittal (C) contrast-enhanced CT scan show a lobulated lesion in the left parotid with fluid density, predominantly, septa in its interior and some soft tissue enhancement following intravenous contrast administration. It presents a small component that extends to the deep lobe of the parotid and maintains an intimate relation with the retromandibular vein, the branch of the mandible and the mastoid.
**Fig. 17:** Parotid. Axial (A), coronal (B) and sagittal (C) contrast-enhanced CT scan show a well-circumscribed lesion in the superficial lobe of the right parotid, with fluid density, fine septa and capsular contrast-enhancement.

© Clínica de Medicina Nuclear e Radiologia de Maceió (MedRadiUs), Maceió, AL, Brazil.

**Fig. 18:** Thyroid. Axial (A), sagittal (B) and coronal (C) contrast-enhanced CT scan show a cystic lesion in the right thyroid lobe.

© Clínica de Medicina Nuclear e Radiologia de Maceió (MedRadiUs), Maceió, AL, Brazil.
Fig. 19: Thyroid. Axial (A) and coronal (B) contrast-enhanced CT scan show a well-circumscribed lesion in the left thyroid lobe, with no significant contrast-enhancement, that extends to the upper mediastinum. It shows intimate contact with the left internal and anterior jugular veins, the trachea and the left common carotid artery.

© Clínica de Medicina Nuclear e Radiologia de Maceió (MedRadiUs), Maceió, AL, Brazil.
Conclusion

CT is an accurate imaging study for evaluating cystic lesions of the neck. This modality provides similar information as the magnetic resonance imaging, but with lower cost and higher availability. CT also demonstrates the full extent of the lesion and gives important supplemental information for preoperative planning.

Radiologists and residents should keep in mind structural imaging abnormalities interpretation and incorporate in their routine in order to support their correlation, highlighting the clinical, embryology, anatomy and pathogenesis.

Personal information

L. P. G. Farias - Hospital Alvorada, São Paulo/SP, Brazil. Faculdade de Medicina da Univeridade Federal de Alagoas, Maceió/AL, Brazil.

I. G. Padilha - Irmandade da Santa Casa de Misericórdia de São Paulo, São Paulo/SP, Brazil. Faculdade de Medicina da Univeridade Federal de Alagoas, Maceió/AL, Brazil.

M. L. L. Soares - Faculdade de Medicina da Univeridade Federal de Alagoas, Maceió/AL, Brazil.

M. A. Cardoso - Clínica de Medicina Nuclear e Radiologia de Maceió (MedRadiUs), Maceió/AL, Brazil.

D. T. Rosa - Clínica de Medicina Nuclear e Radiologia de Maceió (MedRadiUs), Maceió/AL, Brazil.

F. M. N. R. Arraes - Centro Avançado de Otorrinolaringologia (Sinus), Maceió/AL, Brazil.

C. J. J. Santos - Clínica de Medicina Nuclear e Radiologia de Maceió (MedRadiUs), Maceió/AL, Brazil.

C. M. N. R. Miranda - Clínica de Medicina Nuclear e Radiologia de Maceió (MedRadiUs) and Faculdade de Medicina da Univeridade Federal de Alagoas, Maceió, AL, Brazil.
References


