Retrovisceral and Danger Spaces - Anatomy and Pathology Imaging Features and Differential Diagnosis

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Learning objectives

The aim of this educational exhibition is to review the anatomy of retropharyngeal and danger space, as well as the imaging features of the pathologic conditions that can be found in these neck spaces.

Also we intend to illustrate the spread pathways between retropharyngeal and danger space and the pretracheal space and the mediastinum.

Background

<ANATOMY>

Visceral Compartment:

1 - Extends from the skull base to the mediastinum

2 - Is limited by:

-*Visceral fasciae* or *buccopharingeal* ventrally

-*Alar fascia* dorsally
-*Cloison sagittalle* laterally

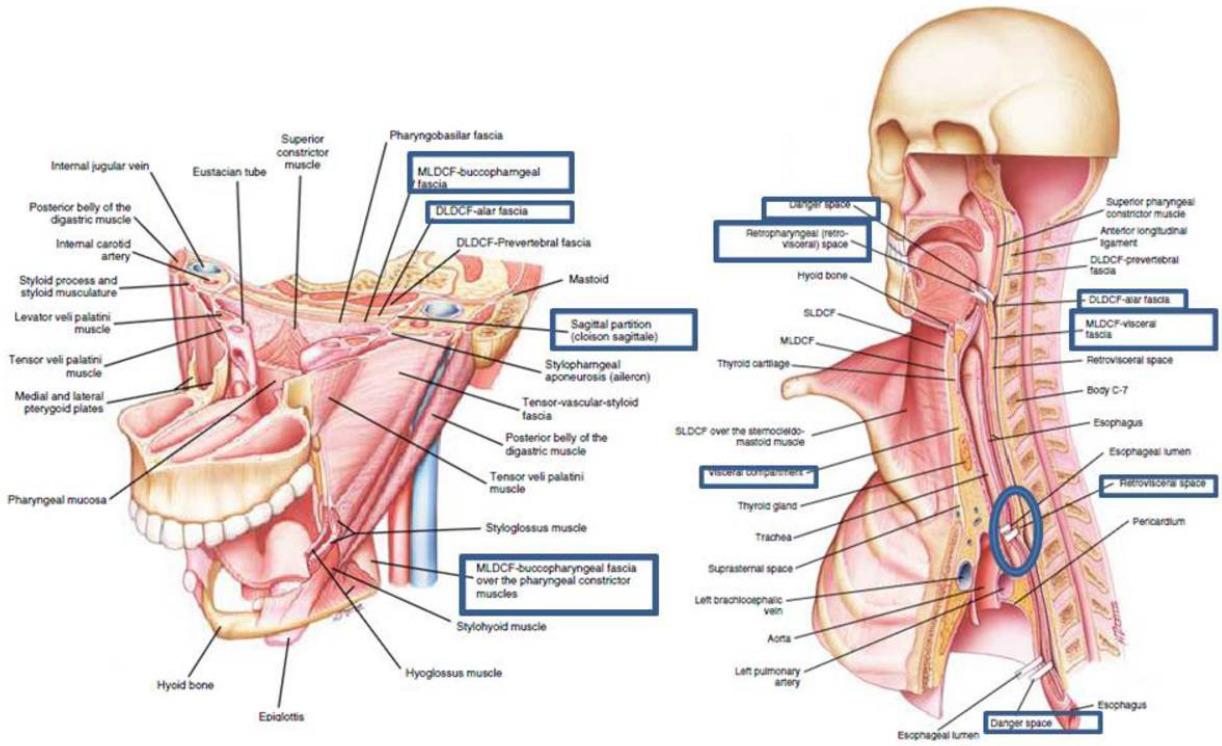


Fig. 1: Depicted relationships of the fascia and visceral compartment to other spaces and the mediastinal structures. Blue circumference: alar fascia and visceral fascia fusion, obliterating the retrovisceral space at the middle mediastinum. Adapted from Som PM (2003) Head and Neck Imaging
References: Som PM (2003) Head and Neck Imaging

3 - Single cranially

4 - Caudal it divides:

#Pretracheal space

- enclosed by:

the strap muscles ventrally

the carotid sheaths laterally

- caudally

continues into the anterior portion of the superior mediastinum

#Retrovisceral space

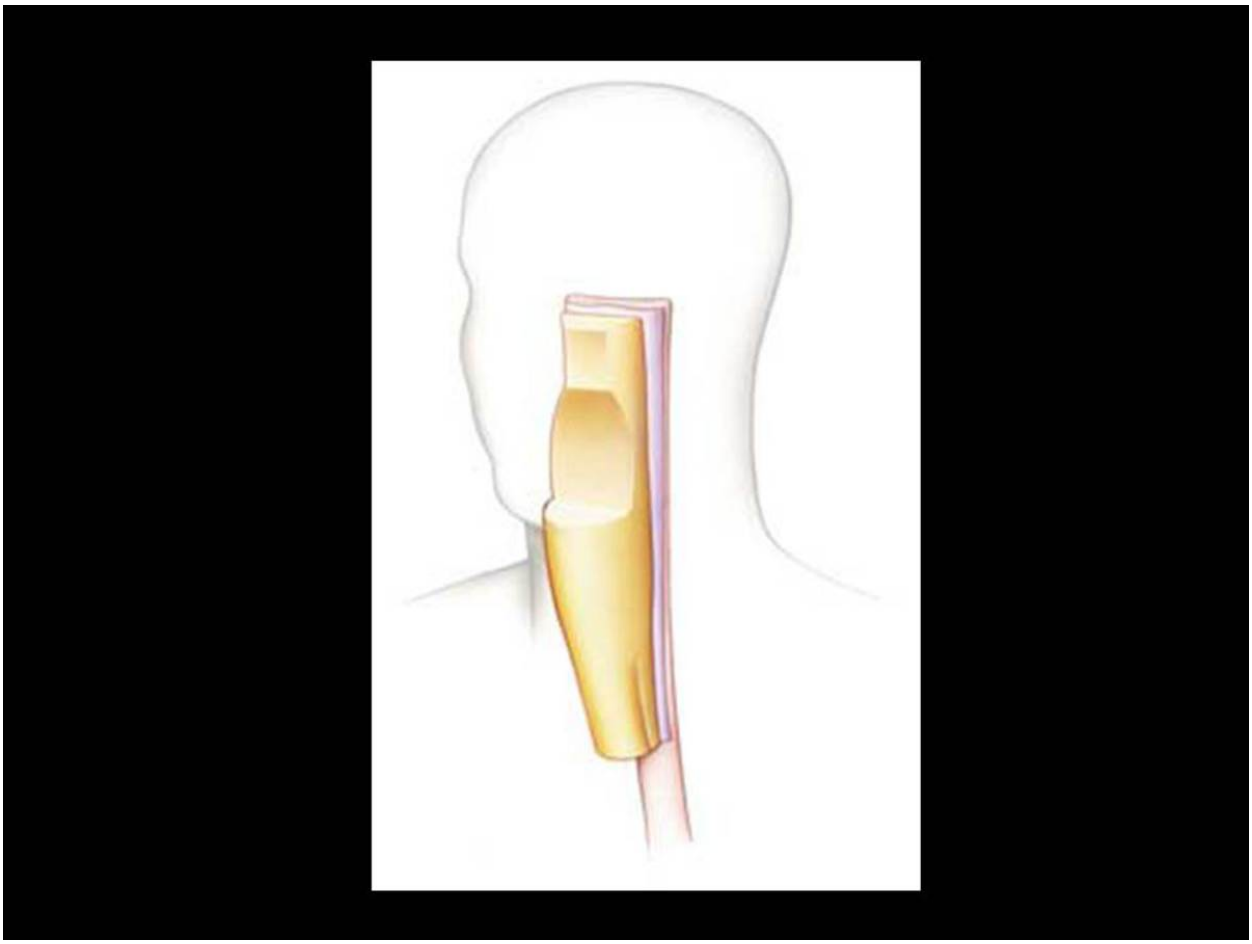


Fig. 2: Visceral compartment block diagram (yellow). Note that the pretracheal space begins at hyoid bone, whereas the retrovisceral begins at skull base. The division of the visceral compartment into the pretracheal space and the retrovisceral space by the fascia that accompanies the inferior thyroid artery is shown as a cleft in the visceral compartment. The pretracheal space extends substernally, while the retrovisceral space extends to about the level of the carina.
References: Som PM (2003) Head and Neck Imaging

RETROVISCERAL SPACE

1. Extends from the clivus to a variable level from T1 to T6 vertebrae, where the alar fascia (its posterior border) fuses with the visceral fascia (its anterior border), obliterating it (Fig. 1, blue circumference). This fusion often occurs at the level of tracheal bifurcation.

2. Surrounds the pharynx and the esophagus.

3. Relations of the retrovisceral space**:**

- Anterior: submandibular space

- Anterolateral (supra-hyoid neck): masticator space

- Posterolateral: parapharyngeal space

- Posterior: danger space

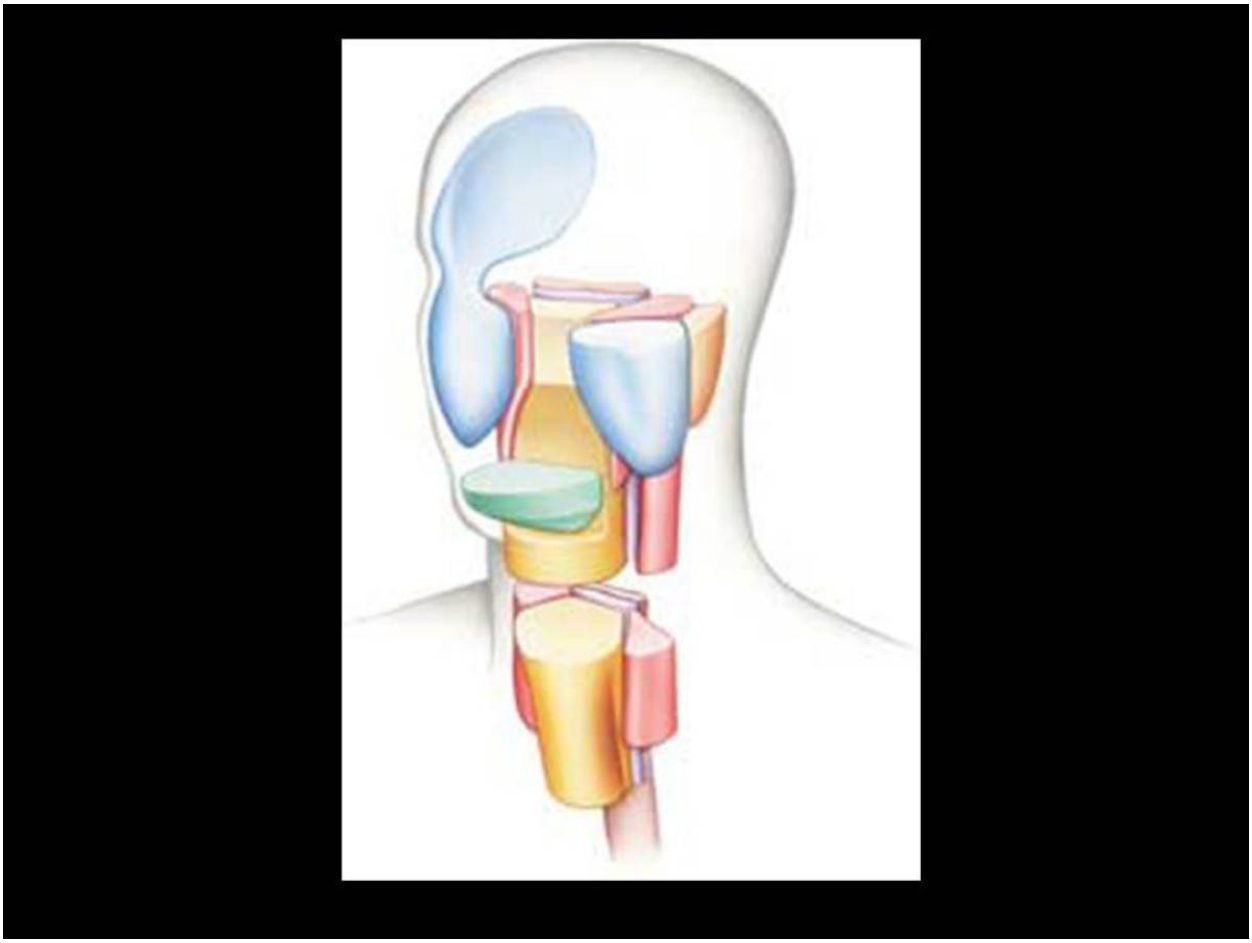


Fig. 3: Block diagram showing the relationships of the visceral compartment (yellow) with the parapharyngeal spaces and the carotid sheaths (pink), the submandibular space (green), the masticator spaces (blue) and the danger space (violet).
References: Som PM (2003) Head and Neck Imaging

4. Retrovisceral space contents:

- *retropharyngeal space:*

- pharynx

- medial and lateral (nodes of Rouvière) retropharyngeal nodal chains

- fat

- small vessels

- *retroesophageal space:*

- esophagus

- fat

- small vessels

5. Communicates with the pretracheal space and with the middle mediastinum.

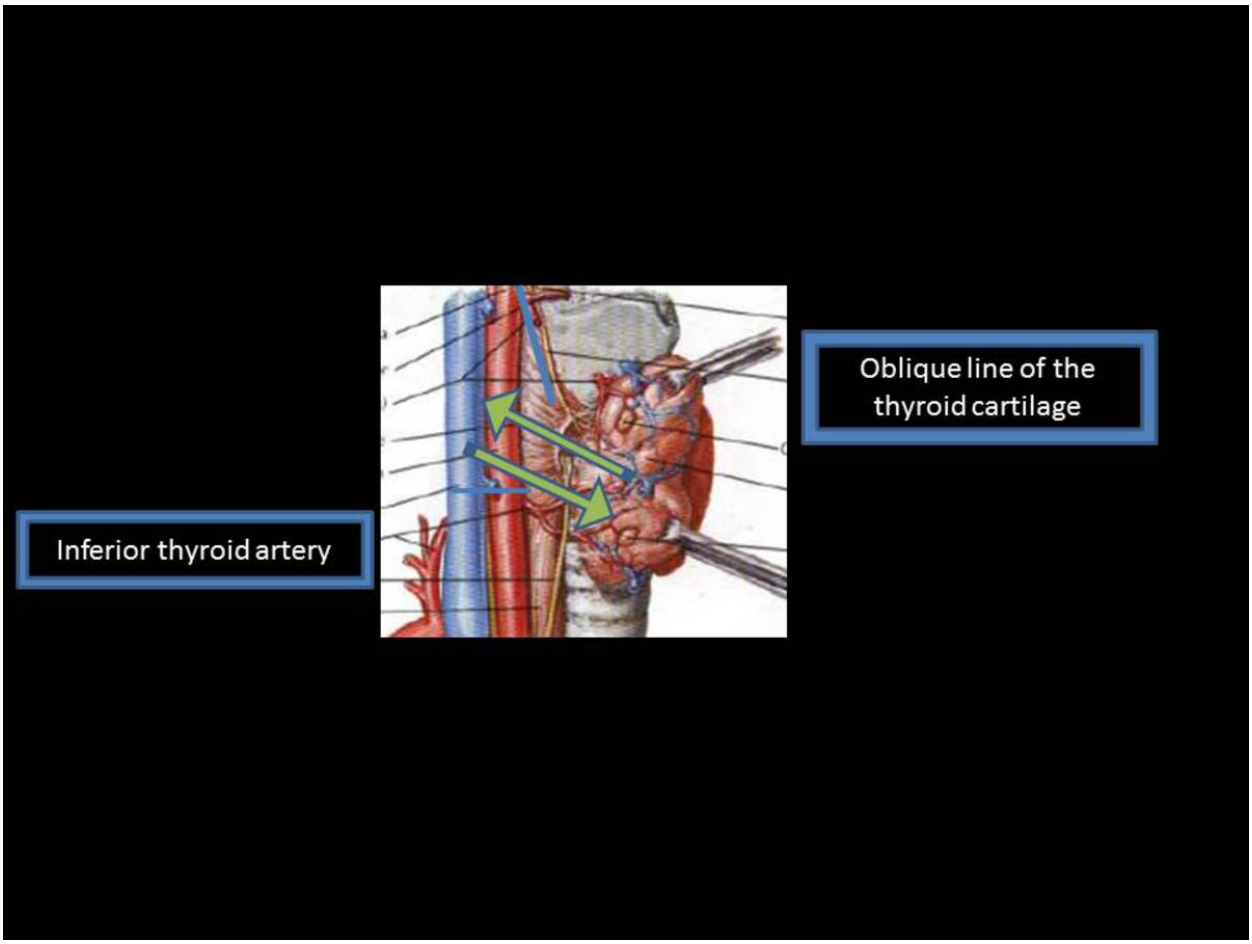


Fig. 4: Limits of the free communication between pretracheal and retrovisceral spaces. Adapted from Netter et all, Atlas of Normal Anatomy.
References: Netter et all Atlas of Normal Anatomy

6. So, the pretracheal and retrovisceral spaces:

- communicate around the sides of esophagus and thyroid gland between the levels of the oblique line of the thyroid cartilage and inferior thyroid artery

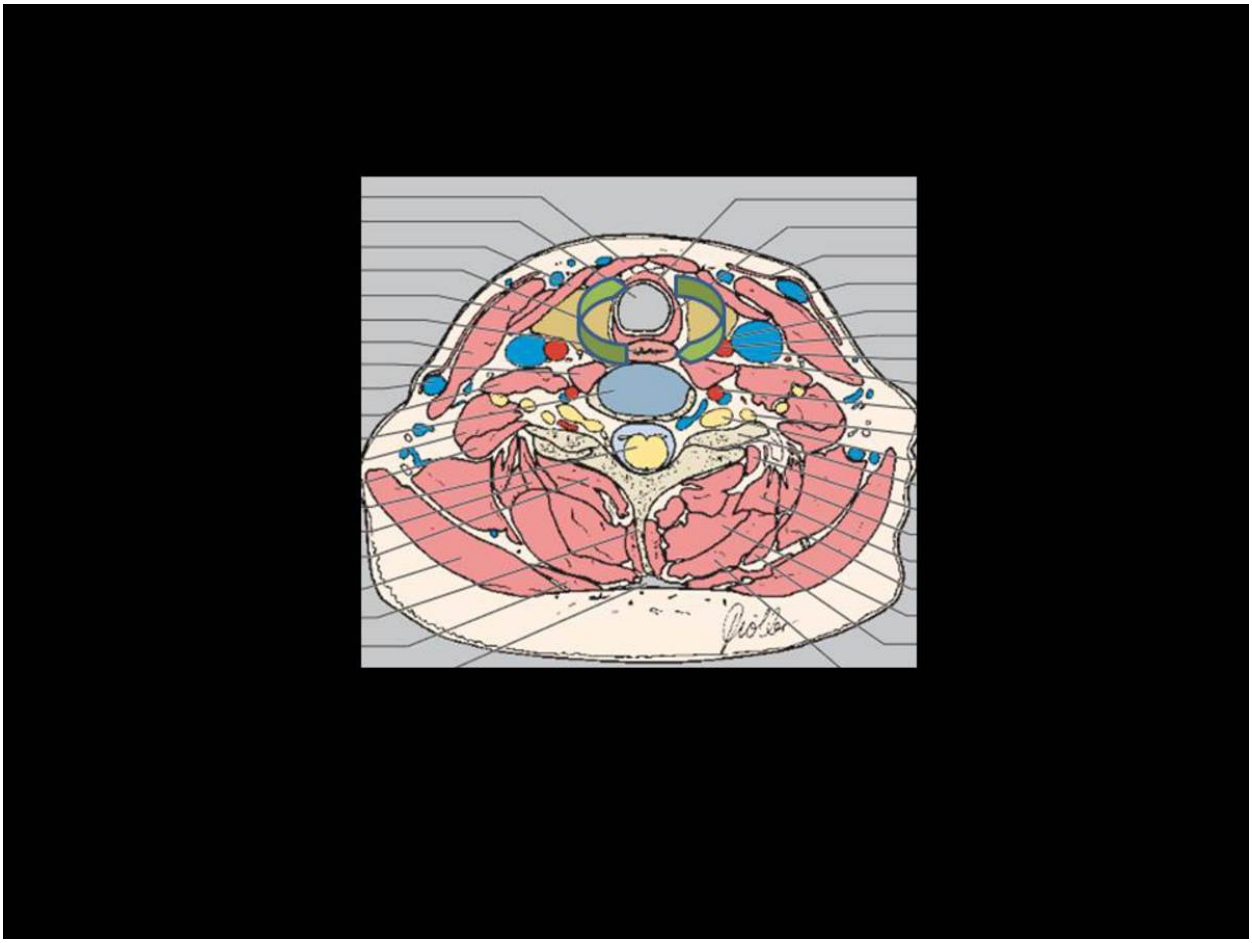


Fig. 5: Free communication around the sides of esophagus and thyroid gland - between the levels of the oblique line of the thyroid cartilage and inferior thyroid artery - between the spaces of the visceral compartment. Adapted from: Moeller TB, Reif E (2007) Pocket of Sectional Anatomy, Computed Tomography and Magnetic Resonance Imaging, Volume I: Head and Neck

References: Moeller TB, Reif E (2007) Pocket of Sectional Anatomy, Computed Tomography and Magnetic Resonance Imaging, Volume I: Head and Neck

- Caudally, the fascia associated with the inferior thyroid artery (dense connective tissue layer attaching oesophagus laterally to carotid sheath and prevertebral fascia) separates the two spaces, from the level where inferior thyroid artery enters the thyroid gland.

Fig. 6: Blue circumference: fascia that accompanies the inferior thyroid artery, and divides caudally the pretracheal from the retrovisceral (retroesophageal)space. Adapted from Som PM (2003) Head and Neck Imaging
References: Som PM (2003) Head and Neck Imaging

DANGER SPACE

1. An area of delicate loose connective tissue that lies between the alar fascia and the prevertebral fascia

2. Relations of the danger space**:**

- Anterior: retrovisceral space

- Lateral (each side): parapharyngeal space

- Posterior: prevertebral space

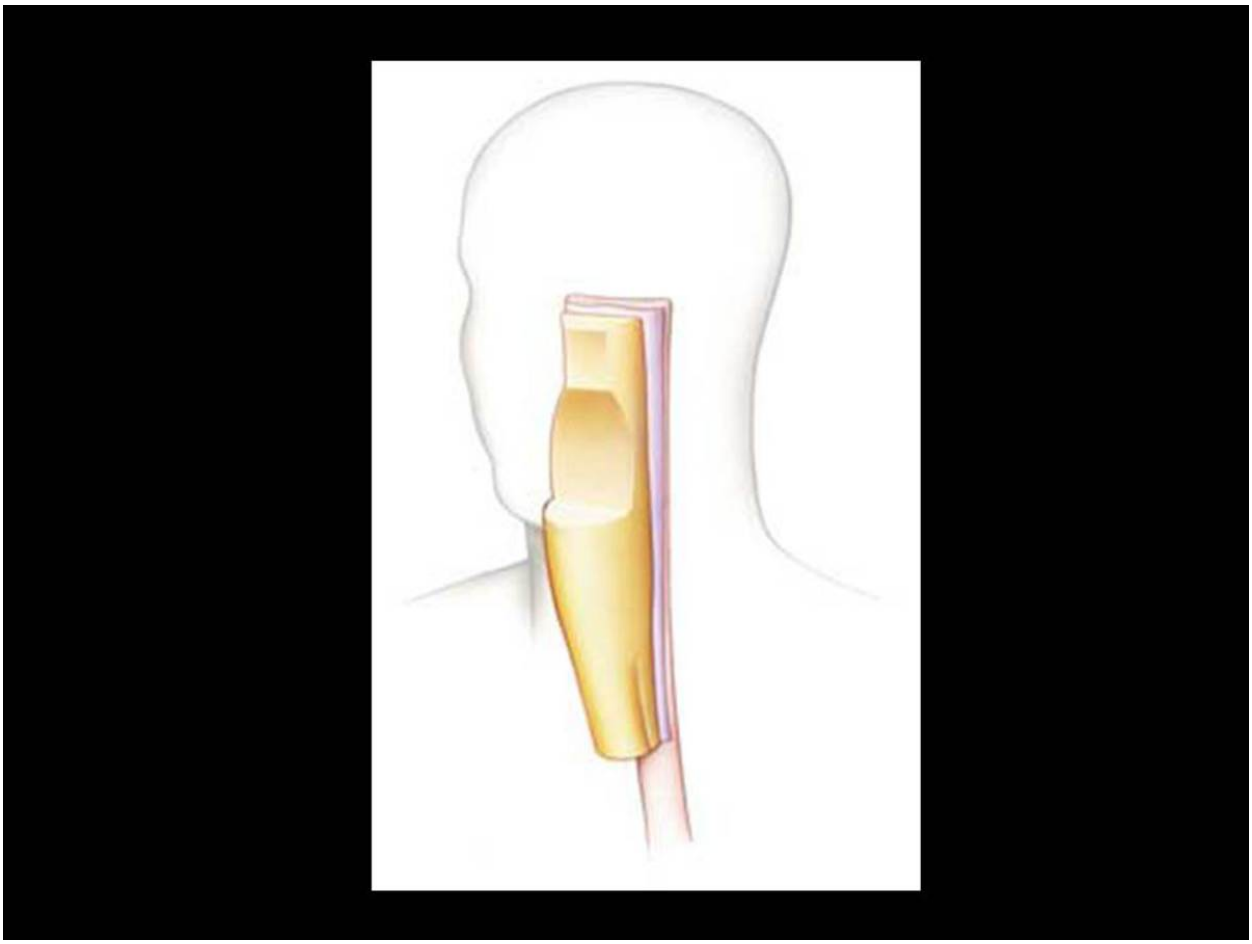
Fig. 7: Block diagram of the danger and the prevertebral spaces.
References: Som PM (2003) Head and Neck Imaging

3. Danger space contents:

- fat

4. *Dangerous*, because it extends further inferiorly into the posterior mediastinum and to the level of the diaphragm. From here it can further communicate with retroperitoneum.

Images for this section:



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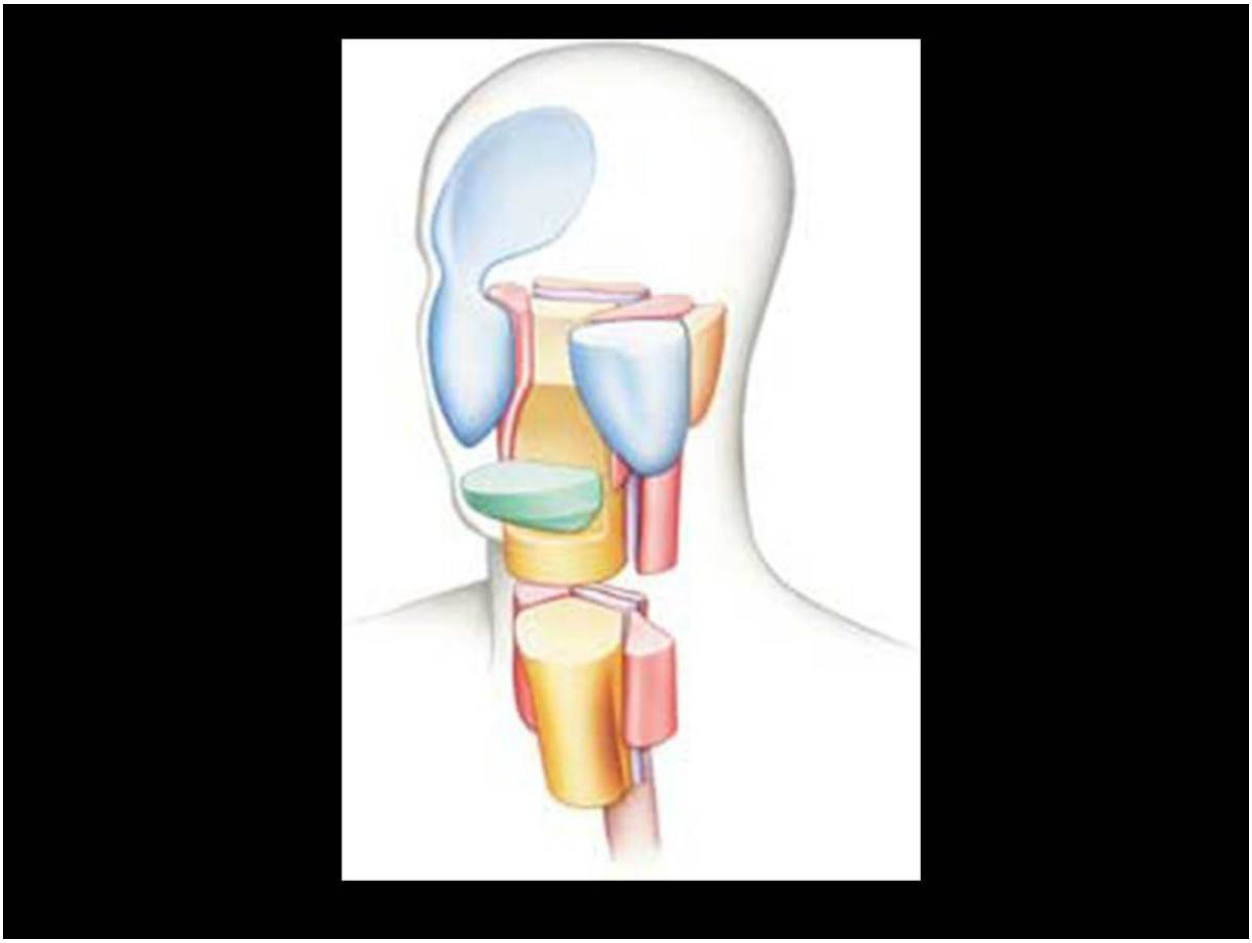

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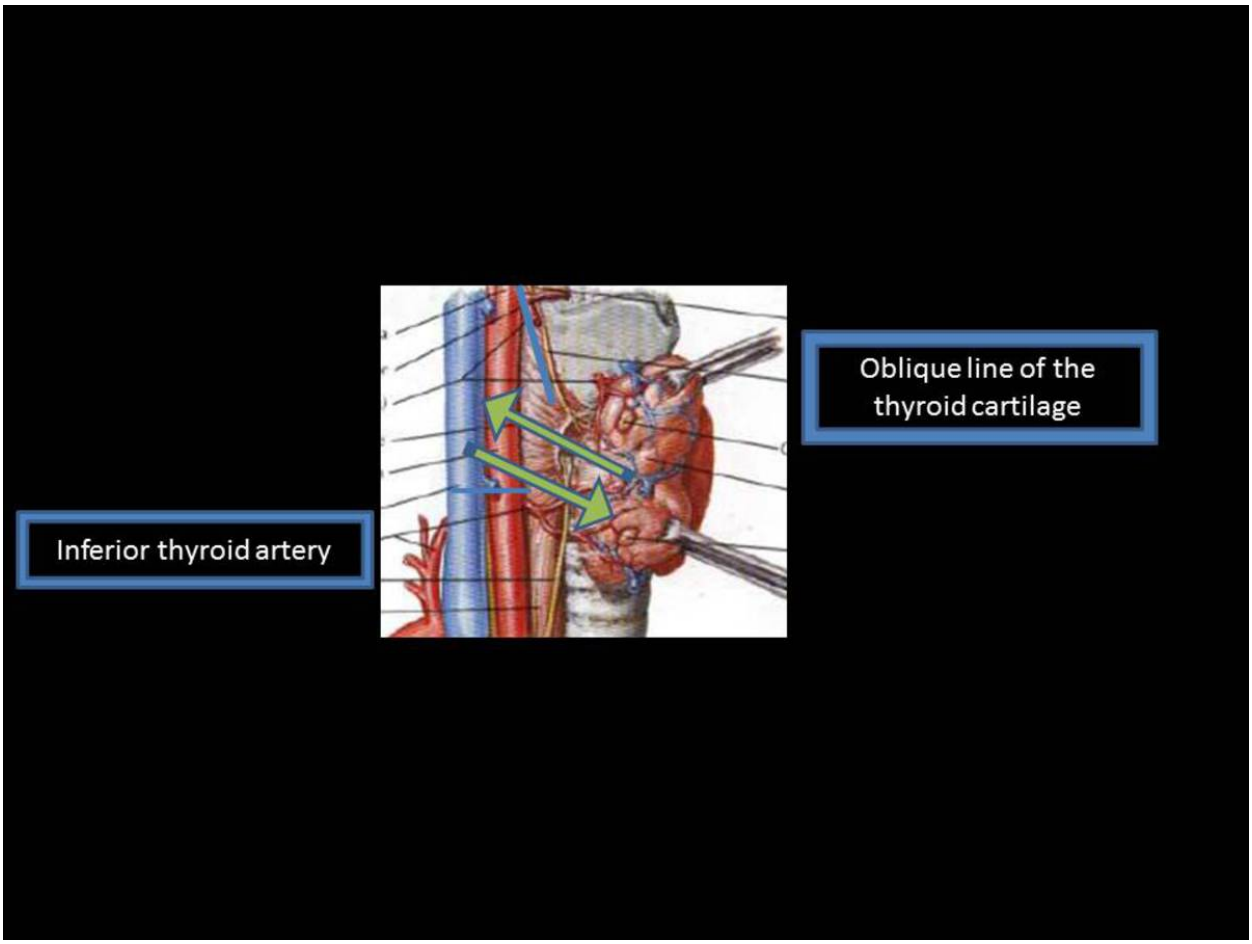
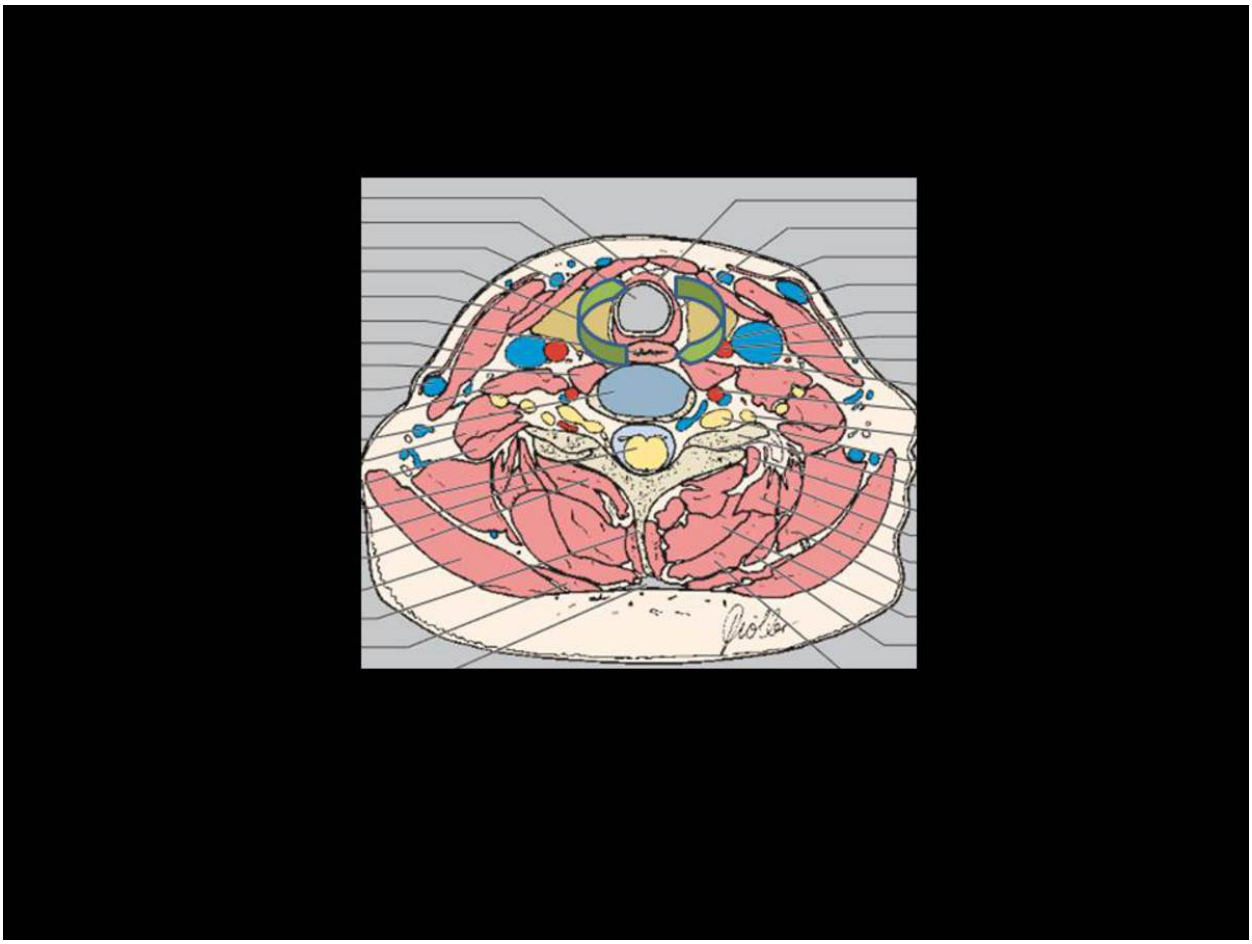


Fig. 4: Limits of the free communication between pretracheal and retrovisceral spaces. Adapted from Netter et all, Atlas of Normal Anatomy.



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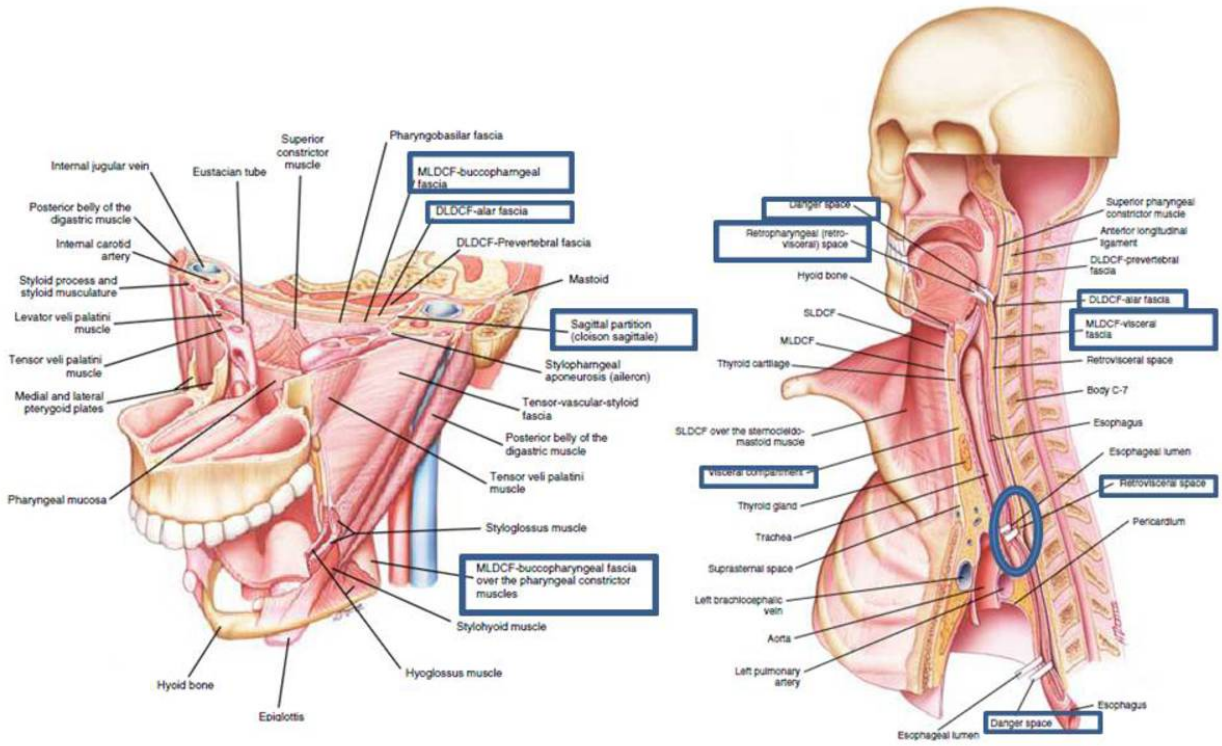

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PSEUDOTUMORS

1 - Tortuous Carotid Arteries

Tortuous Carotid Arteries can meander medially into the retropharyngeal space. Although enhanced computed tomography can simply prove their vascular origin, care should be taken not to confound them for masses when only unenhanced CT is performed. So this should be kept in mind, to promptly recognize these mimickers.

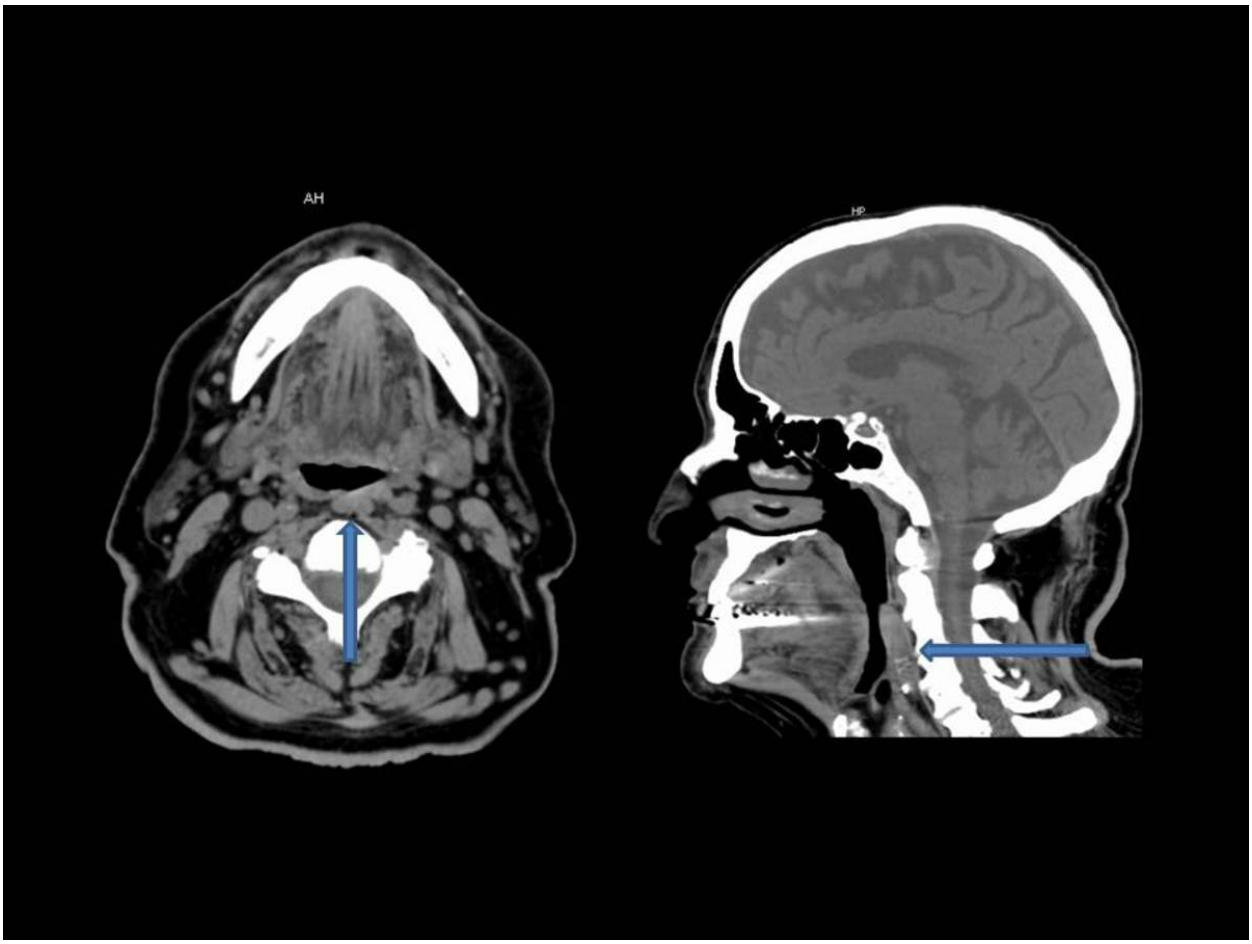

Fig. 8: Tortous internal carotid arteries. Unenhanced computed tomography - axial and sagital views - demonstrates a retropharyngeal mass.

References: M. L. O. O. Coelho; radioogia, Porto, PORTUGAL

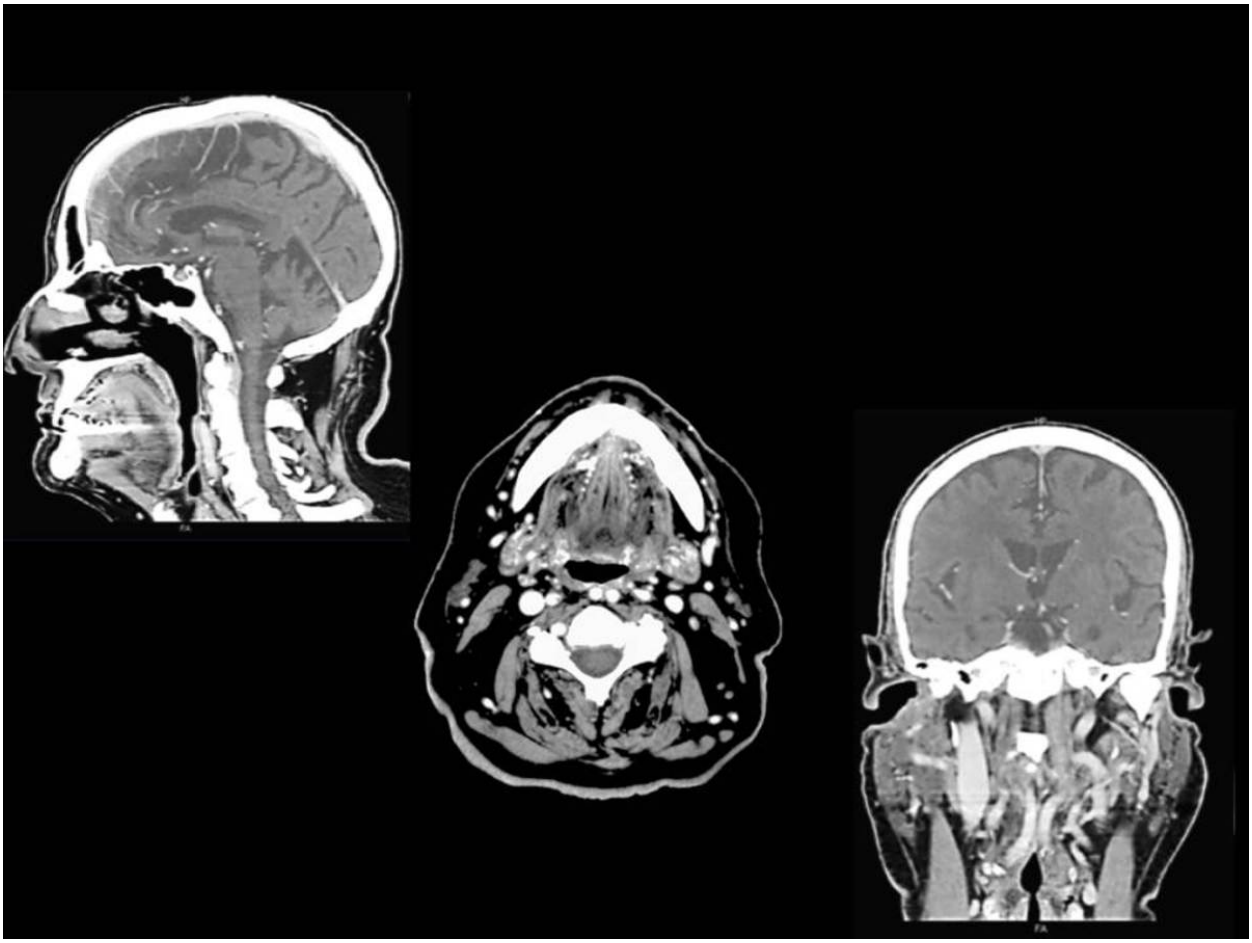

Fig. 9: Tortous internal carotid arteries. Same patient of Fig.8.: enhanced computed tomography - sagital, axial and coronal views - demonstrates medial deviation of both internal carotid arteries into the retropharingeal space.
References: M. L. O. O. Coelho; radioogia, Porto, PORTUGAL

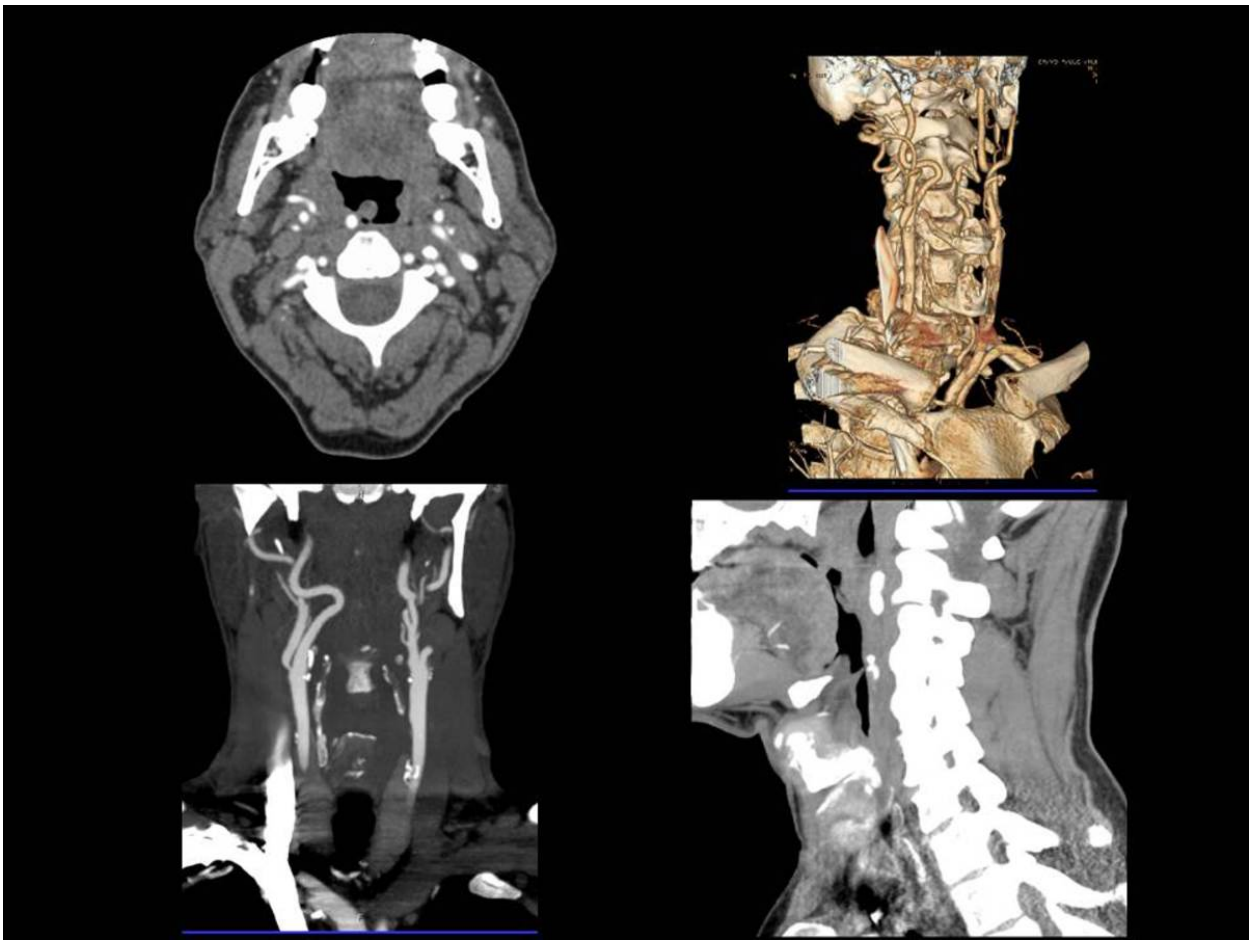

Fig. 10: Tortous internal right carotid artery. Enhanced Computed Tomography - Sagital, Axial, Coronal and Volume Render views - demonstrates tortuosity and medial deviation of right carotid artery into the retropharyngeal space.
References: M. L. O. O. Coelho; radioogia, Porto, PORTUGAL

Note, that anatomy can also explain why internal carotid artery can occupy the retropharingeal space. In fact, cranial to the common carotid artery bifurcation the carotid sheath is incomplete, with variable areas of dehiscence (being a complete and well defined structure distally).

2 - Pseudotumoral edema

Collected edema or fluid results from altered lymphatic drainage or excess production of lymph. These can occur after chemotherapy or radiation therapy (Fig. 9 e 10), jugular thrombosis or resection, superior vena cava syndrome, longus colli tendonitis, pharyngitis or other head and neck inflammatory condition (Fig 11 e 12).

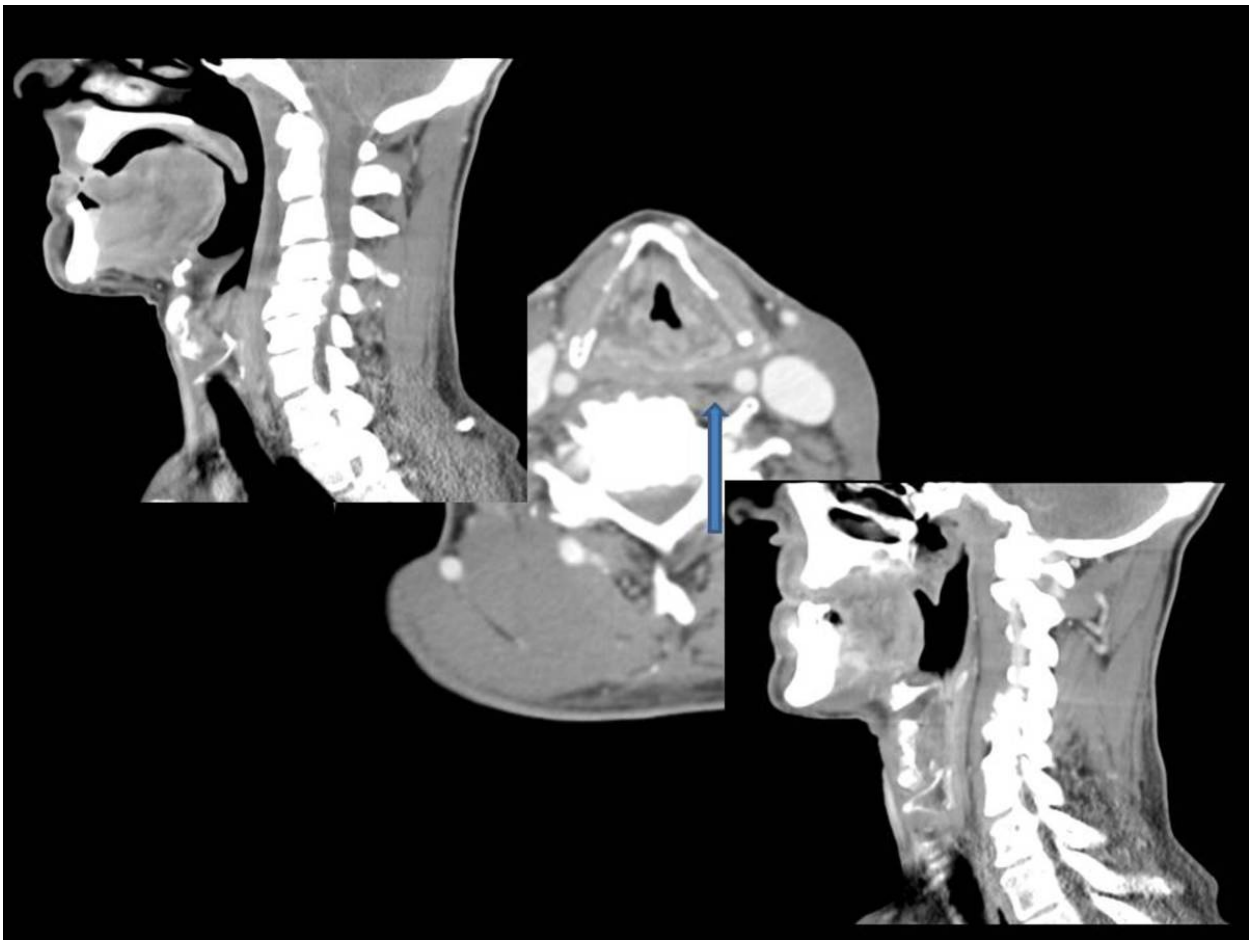

Fig. 11: Retropharyngeal edema: axial and sagital enhanced computed tomography images of a 56 year-old man who had been submitted to neck radiation therapy three months ago to treat a glottic carcinoma. Note the retropharyngeal space swelling and a small amount of fluid in its left half (blue arrow). The fluid collection has a fusiform configuration and tapered margins, with no mass effect and no enhancement.
Acknowledgment to the Department of Neuroradiology of the Centro Hospitalar do Porto.
References: M. L. O. O. Coelho; radioogia, Porto, PORTUGAL

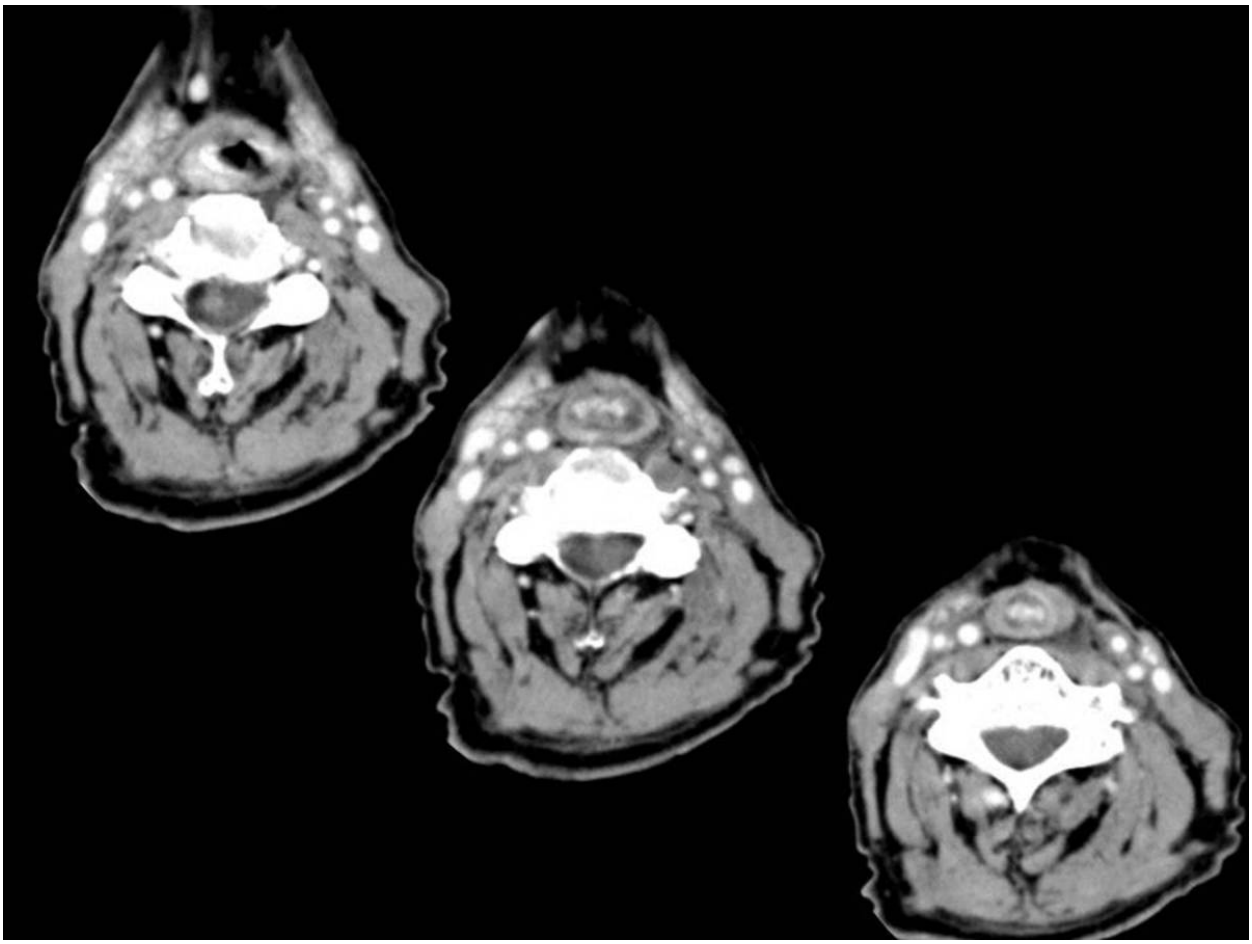

Fig. 12: Retropharyngeal edema: axial enhanced computed tomography images of a 60 year-old man submitted to total laryngectomy and neck radiation therapy. Moderate diffuse swelling and enhancement of the pharyngeal wall associated with mild swelling and small amount of fluid in the retropharyngeal space. Note that there are postradiation imaging findings also in the carotid sheath and the internal jugular veins are thinner.
References: M. L. O. O. Coelho; radioogia, Porto, PORTUGAL

Special care must be taken not to confuse the edema of the retropharyngeal space associated with infections in other spaces of the neck with abscess. The edema usually fills uniformly the retropharyngeal space from side to side, has smooth, ovoid, rectangular or "bow-tie" configuration on axial imaging and a diffuse craniocaudal distribution on sagittal images, with tapered inferior and superior margins. Mass effect is non-existent or mild and there isn't wall thickening or enhancement, contrarily to an abcess.

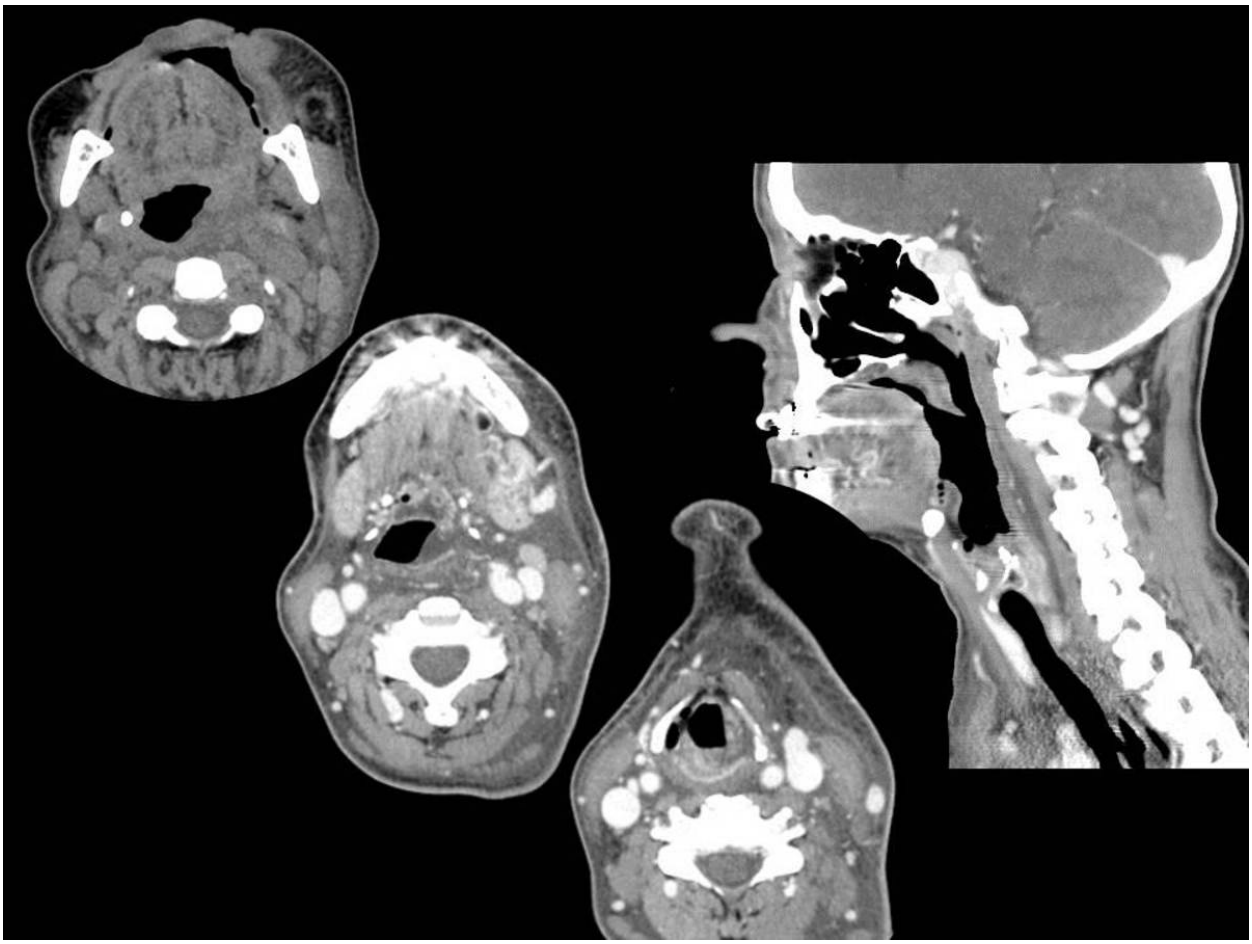

Fig. 13: Retrovisceral edema: axial unenhanced and axial and sagittal enhanced computed tomography images of a 63 year-old woman with left paroditis and cheek cellulitis. Fluid fills the retropharyngeal space from side to side (although of greater volume on the left), has an ovoid configuration and tapered inferior and superior margins, with mild mass effect. It does not enhance.
References: M. L. O. O. Coelho; radioogia, Porto, PORTUGAL

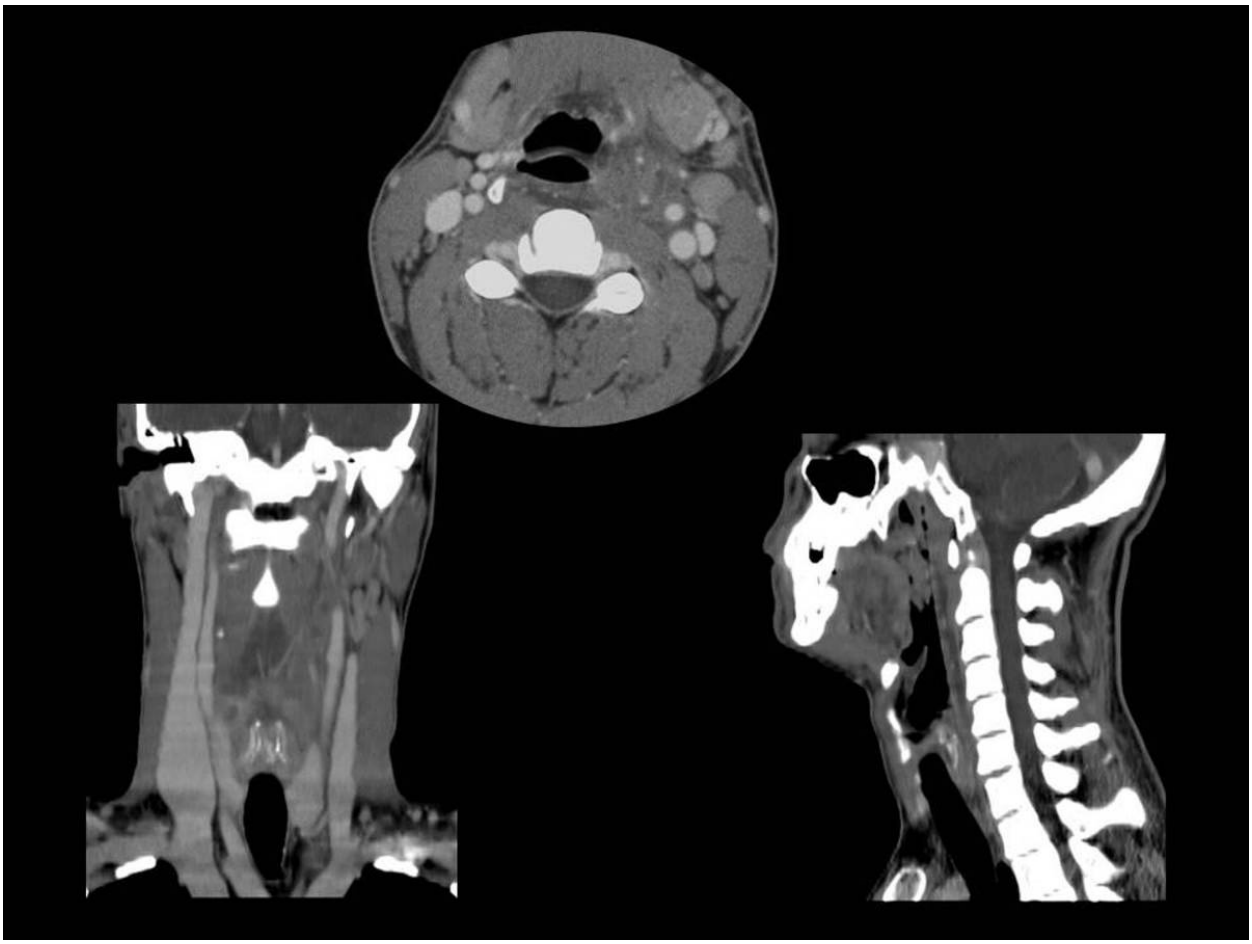

Fig. 14: Retrovisceral edema: axial, coronal and sagital enhanced computed tomography images of a 30 years old man with pharyngitis and an parapharyngeal abscess. Fluid fills the retropharyngeal space from side to side, has a rectangular configuration and tapered inferior and superior margins, with no mass effect or wall enhancement.
References: M. L. O. O. Coelho; radioogia, Porto, PORTUGAL

SUPPURATIVE RETROPHARYNGEAL NODE AND RETROPHARYNGEAL AND DANGER SPACE ABCESSES

The retropharyngeal nodes drain the nasopharynx, oropharynx, nasal cavity, paranasal sinuses, middle ears and prevertebral space. They normally involute before puberty and they shouldn't be larger than 8mm.

As an infection drains to these nodes, they enlarge as the result of proliferation and invasion of inflammatory cells - reactive lymphadenopathy. As it evolves, nodes can become edematous - pressupurative phase - and after they develop necrosis and

eventually pus formation - suppurative retropharyngeal node. In this phase, confusion with retropharyngeal abscess can occur. It is important to prevent this misdiagnosis, as only suppurative nodes that show progression after medical therapy and the ones that are large at presentation should be submitted to surgical drainage.

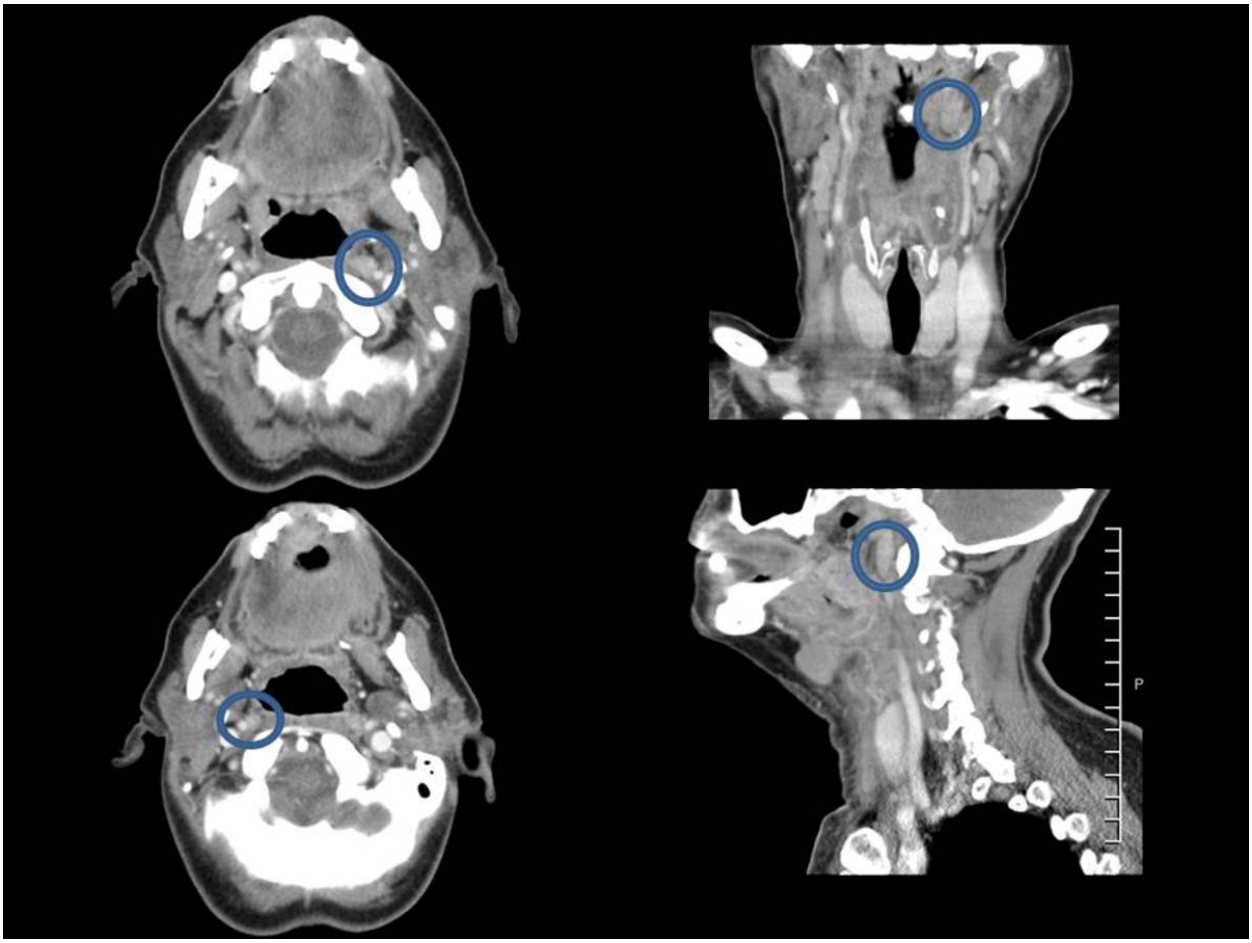

Fig. 15: Reactive retrovisceral nodes. Axial, coronal and sagittal enhanced computed tomography images, at the level of nasopharynx, depicting reactive Rouvière nodes (blue circles) in a 49 year-old woman who has a pretracheal abcess, extending to the retropharyngeal space (see Fig. 16). The nodes are enlarged and enhancing, but don't present hypodense centers. Acknowledgment to the Department of Neuroradiology of the Centro Hospitalar do Porto.
References: M. L. O. O. Coelho; radioogia, Porto, PORTUGAL

Suppurative nodes have arounded or oval configuration, and as they enlarge they can have moderate mass effect. An enhancing thin rim can be found around the necrotic center. They normally spare the midline and are associated with retropharyngeal edema.

As the volume of the hypodense center increases, the possibility of presence of purulent material and the need for surgical treatment raises.

Note that retropharyngeal metastatic nodes can have the same imaging appearance, but usually the clinical context and other ancillary findings can help in the differential diagnosis.

Fig. 16: Retropharyngeal suppurative node and retropharyngeal edema. Axial and sagital enhanced computed tomography images, at the level of naso to oropharynx, of a 63 years old woman with left parotiditis and cheek cellulitis. Blue circles depict a very small collection, with thin high-density rim and mild mass effect - this is consistent with a suppurative lymph node.It is important to notice that in a different patient the same imaging appearance could represent a retropharyngeal metastatic node. The images also show associated retropharyngeal edema, as previously described (Fig. 13).
References: M. L. O. O. Coelho; radioogia, Porto, PORTUGAL

Retropharyngeal abscess can result from:

- spread of infection from contiguous spaces through

- the anatomical fascial gaps

- crossing fascial planes

- rupture of a suppurative retropharyngeal node, the most common cause

- direct inoculation from penetrating trauma

An infection in the retropharyngeal space may cross the thin alar fascia into the **danger space** (most common), spread through an incomplete carotid sheath or reach the pretracheal space. From them, infection can reach, respectively, the posterior, middle and anterior mediastinum, where it can result in mediastinitis, pericarditis, pleuritis and empyema.

A retropharyngeal/danger space abscess appears as a collection that:

- fills the retropharyngeal/danger space from side to side

- has an oval or rounded configuration

- produces moderate to marked mass effect - can flatten prevertebral muscles, but also compress the airway (the most urgent complication).

- has a thick enhancing wall

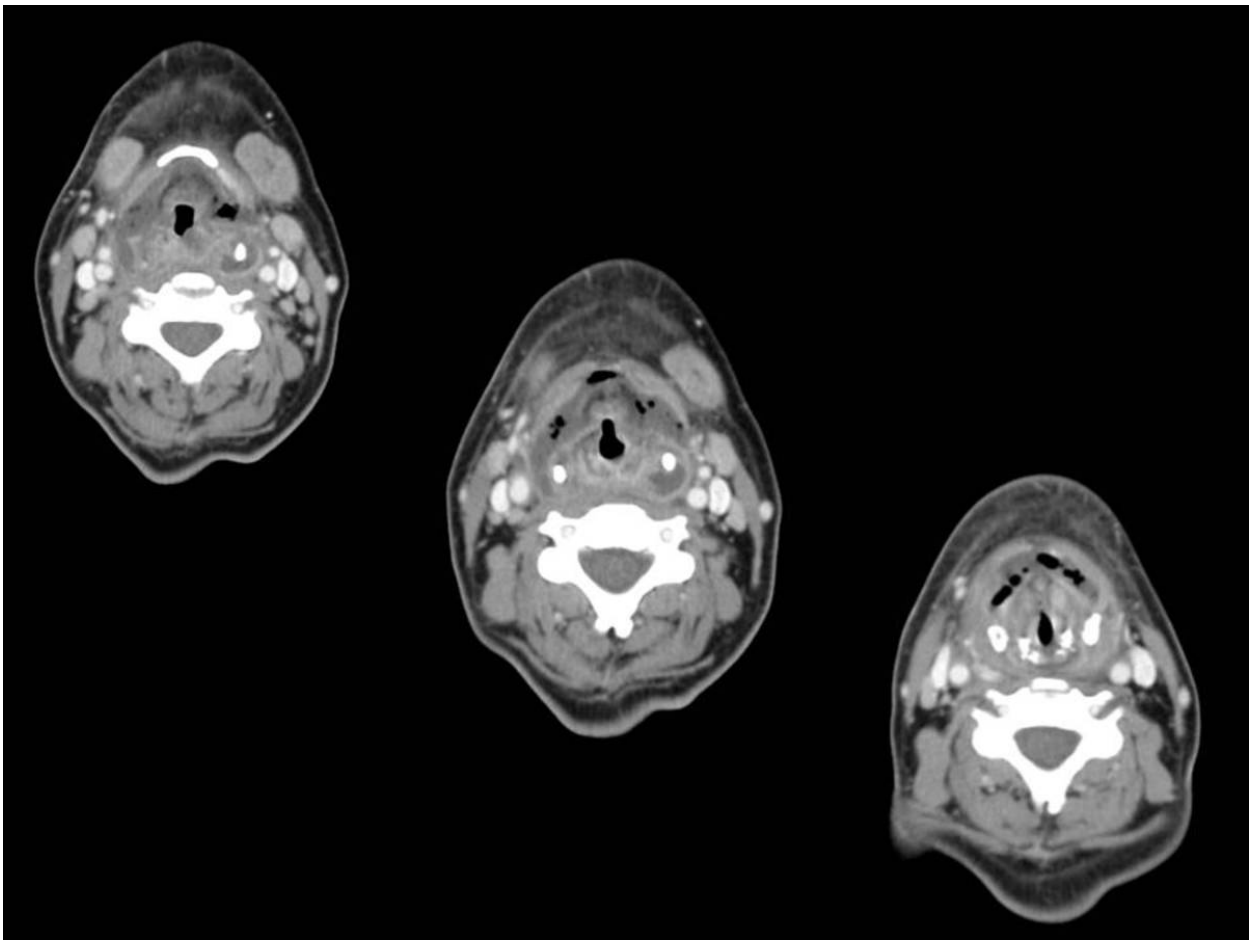

Fig. 17: Pretracheal and retrovisceral abscess. Axial enhanced computed tomography images, at the level of hypopharynx in a 49 year-old woman who has a pretracheal abcess, extending to the retrovisceral space, where we can find an oval collection with thick enhancing wall, producing some mass effect on the left pharyngeal wall. Retrovisceral edema is also present at midline. Acknowledgment to the Department of Neuroradiology of the Centro Hospitalar do Porto.
References: M. L. O. O. Coelho; radioogia, Porto, PORTUGAL

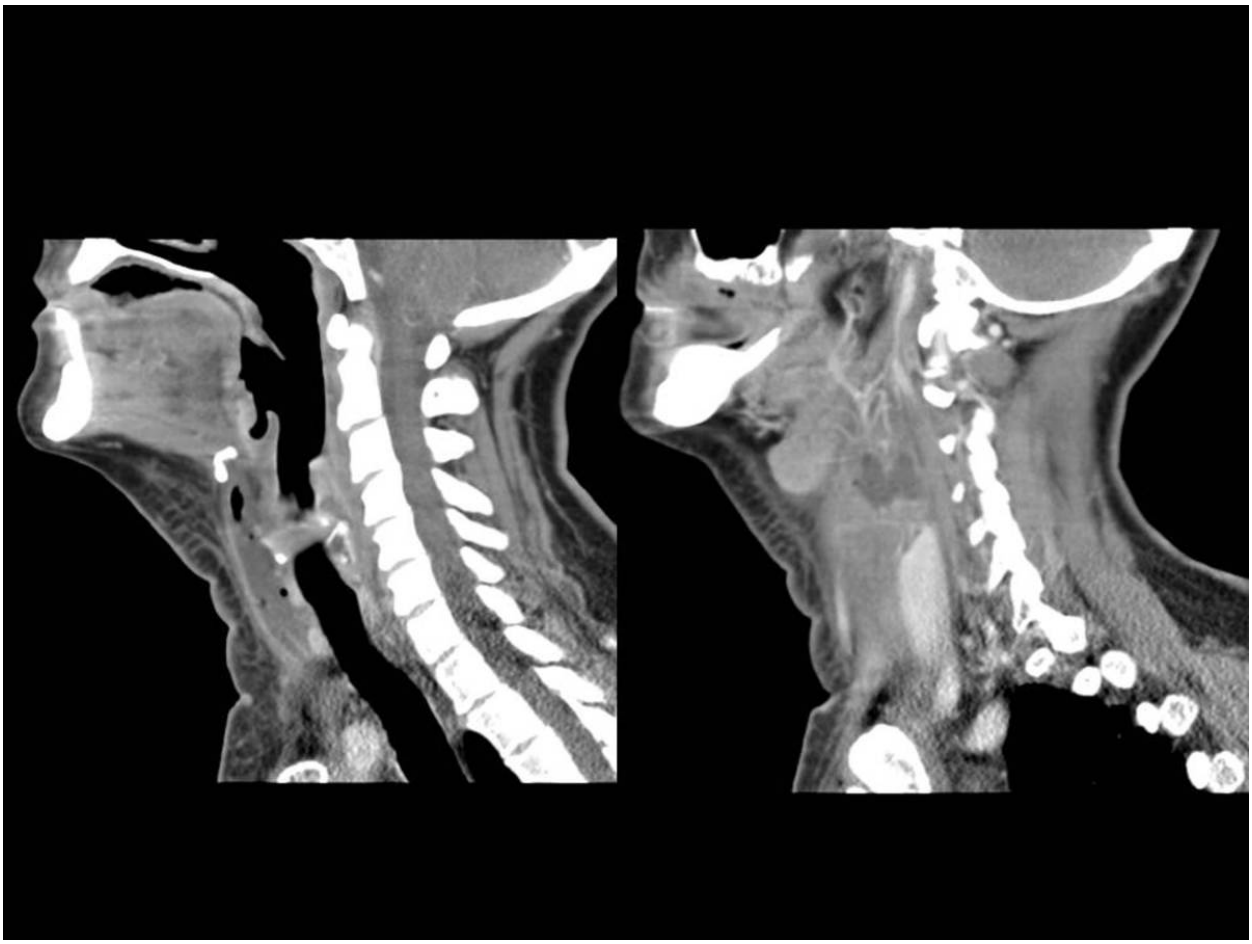

Fig. 18: Pretracheal and retrovisceral abscess. Sagittal enhanced computed tomography images of the same patient from Fig.16, where one appreciate a collection with enhancing wall around the sides of pharynx, spreading to the retrovisceral space through the "gap" between the levels of the oblique line of thyroid cartilage and the inferior thyroid artery (right image. The left image shows a fluid and gas collection on the pretracheal space. Acknowledgment to the Department of Neuroradiology of the Centro Hospitalar do Porto.
References: M. L. O. O. Coelho; radioogia, Porto, PORTUGAL

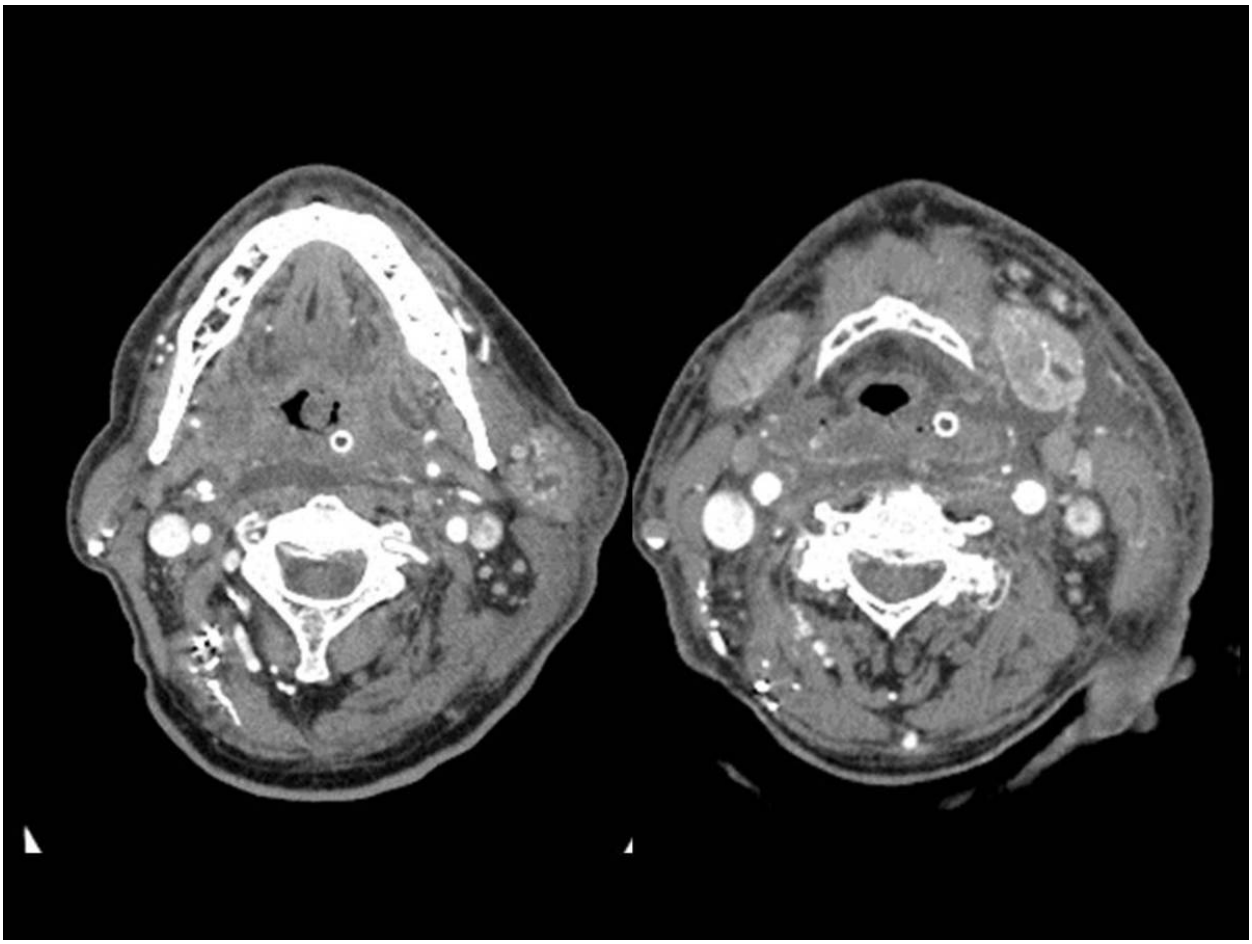

Fig. 19: Retrovisceral and danger space abscess. Axial enhanced computed tomography images of an 73 year-old man with a complicated left parotiditis. Posterior to the pharynx we can see a collection that fills the retrovisceral/danger space from side to side and has a thick enhancing wall. There is also thickening of the pharyngeal wall. In the left image we can observe swelling of the left parotid, with abnormal parenchymal enhancing and a small collection inside it. The right image shows that the infection occupies also the leftsubmandibular and parapharyngeal spaces.
References: M. L. O. O. Coelho; radioogia, Porto, PORTUGAL

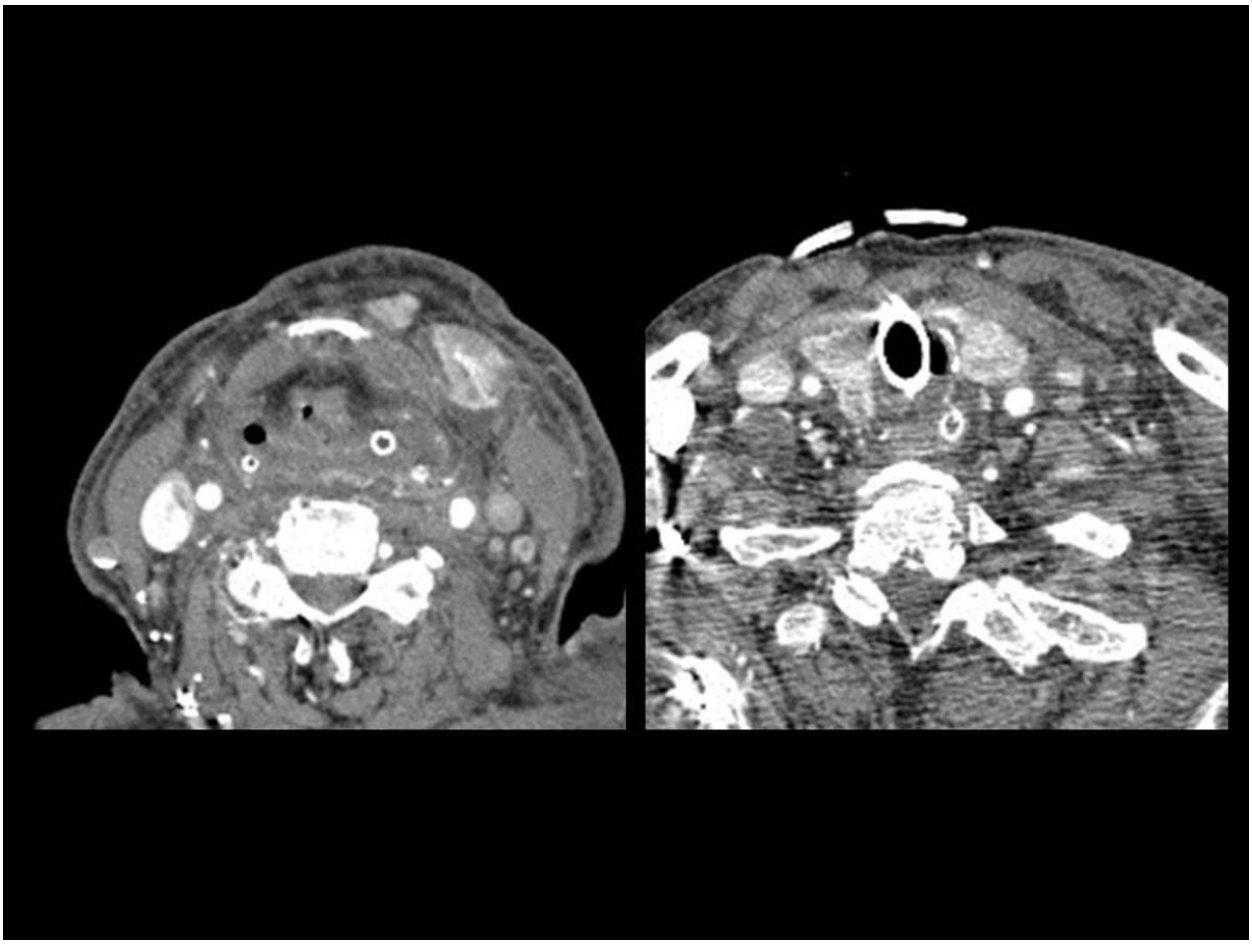

Fig. 20: Retrovisceral and danger space abscess. Same patient from Fig.19. Axial enhanced computed tomography images at the level of the hypopharynx. The phayngeal wall thickning and the retrovisceral/danger space collection produced mass effect on the airway, so patient needed intubation. There is also flattening of the prevertebral muscles.
References: M. L. O. O. Coelho; radioogia, Porto, PORTUGAL

Fig. 21: Retrovisceral and danger space abscess. Same patient from Fig.19. Sagittal and coronal enhanced computed tomography images. Note the phayngeal wall swelling and the retrovisceral/danger space collection (extending caudally) mass effect on the airway, obliterating it.
References: M. L. O. O. Coelho; radioogia, Porto, PORTUGAL

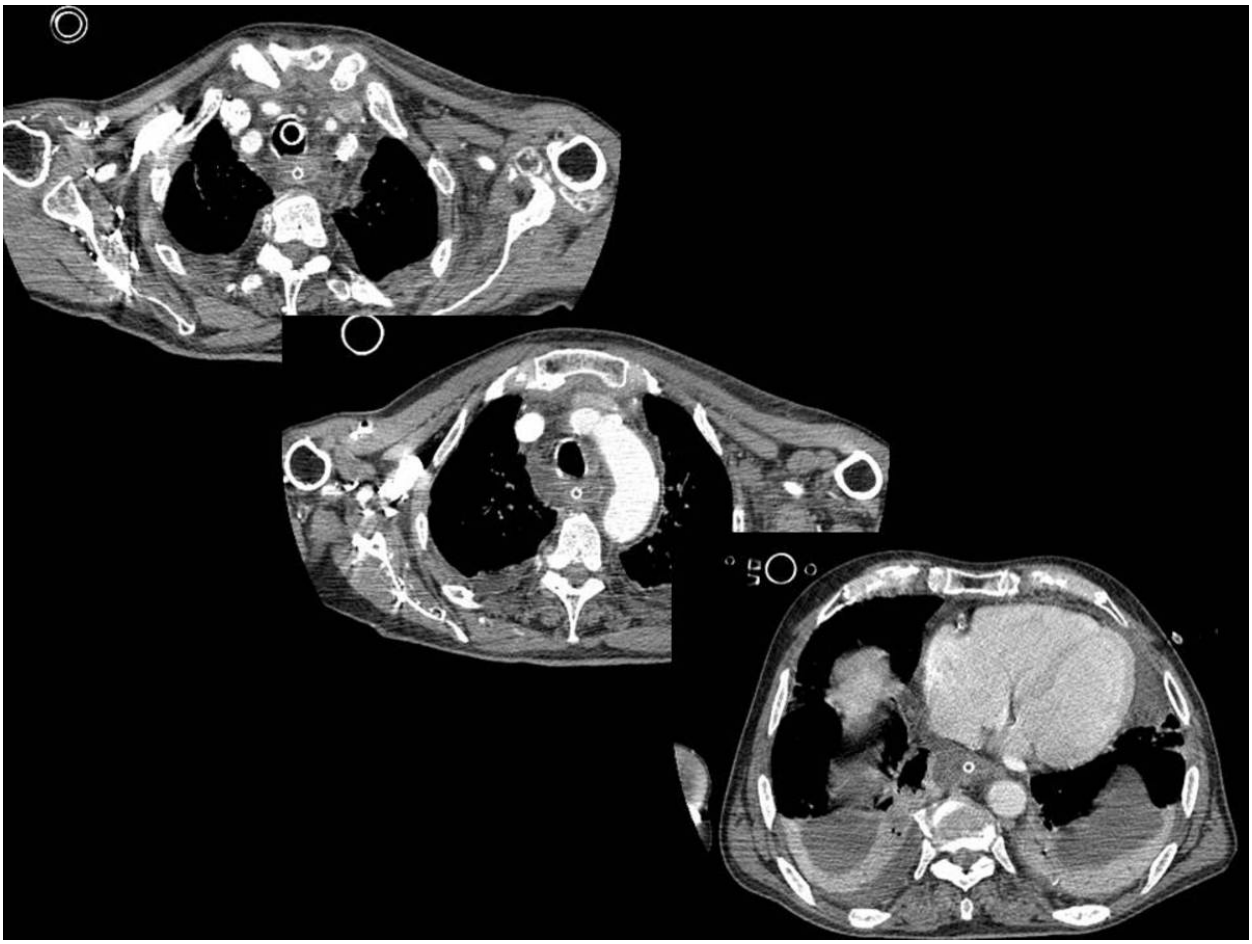

Fig. 22: Retrovisceral/danger space abscess complicated with descending mediastinitis. Same patient from Fig.19. Thoracic axial enhanced computed tomography images. Despite the fact that all the mediastinal fat has an increased attenuation, it is obviously in the posterior mediastinum, surrounding the esophagus, that a collection is evident. There are also signs of bilateral empyema - collected pleural effusion (inferior image) and enhancing pleural thickening (best depicted in the middle image) - and bilateral lung parenchymal consolidation.
References: M. L. O. O. Coelho; radioogia, Porto, PORTUGAL

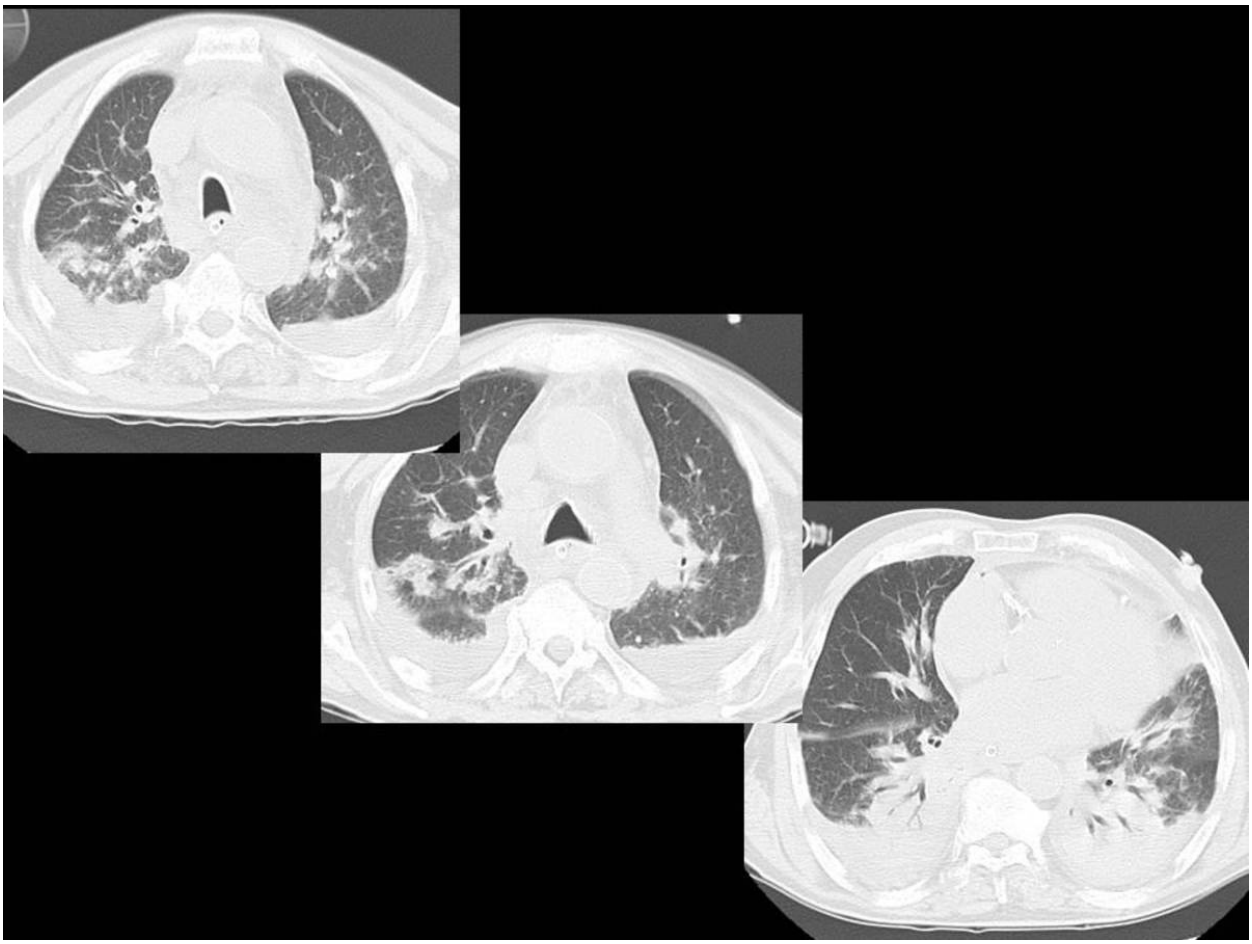

Fig. 23: Retrovisceral/danger space abscess complicated with descending mediastinitis, empyema and pneumonia. Same patient from Fig.19. Thoracic axial enhanced computed tomography images, lung window. Bilateral lower lobe pneumonic consolidation with air bronchogram associated with partial passive colapse related to the empyema. Bronchial wall thicking and peribronchial consolidation in all lobes is apparent, as well as small nodules in the superior lobes at the bronchial extremities - bronchopneumonia.
References: M. L. O. O. Coelho; radioogia, Porto, PORTUGAL

POS-TRAUMATIC LESIONS

Retropharyngeal and danger space emphysema may be caused by direct trauma, infection, foreign body ingestion or assisted ventilation. It can also occur by air dissection from other neck spaces or from the mediastinum.

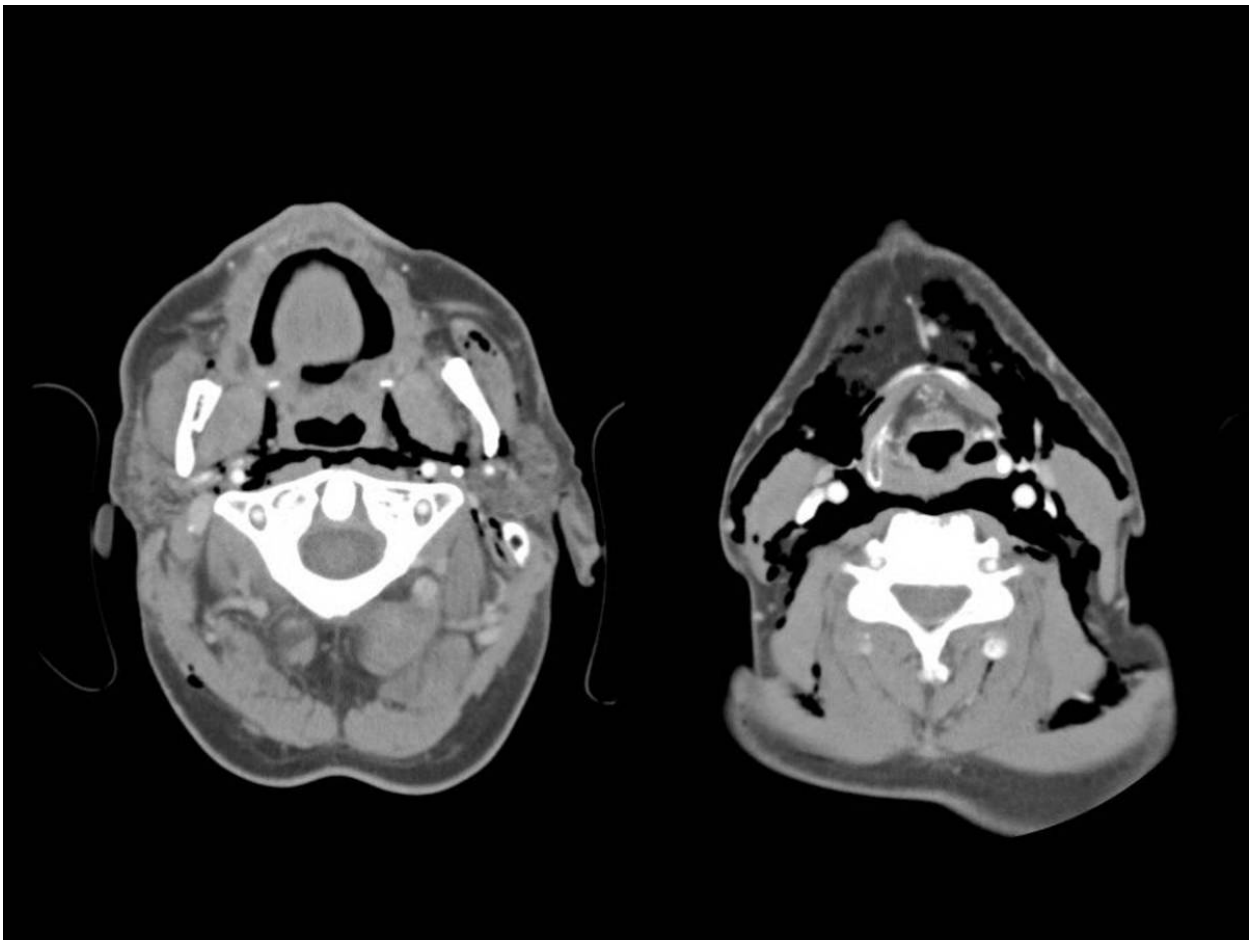

Fig. 24: Retrovisceral and danger space emphysema. Axial computed tomography images of a 70 year-old man who developed extensive neck emphysema after tracheostomy and assisted ventilation. Air is present in all neck spaces. Note that it delineates the fascial planes between the retropharyngeal/danger spaces and the parapharyngeal space (left image) and between the retropharyngeal and the pretracheal spaces (right).
References: M. L. O. O. Coelho; radioogia, Porto, PORTUGAL

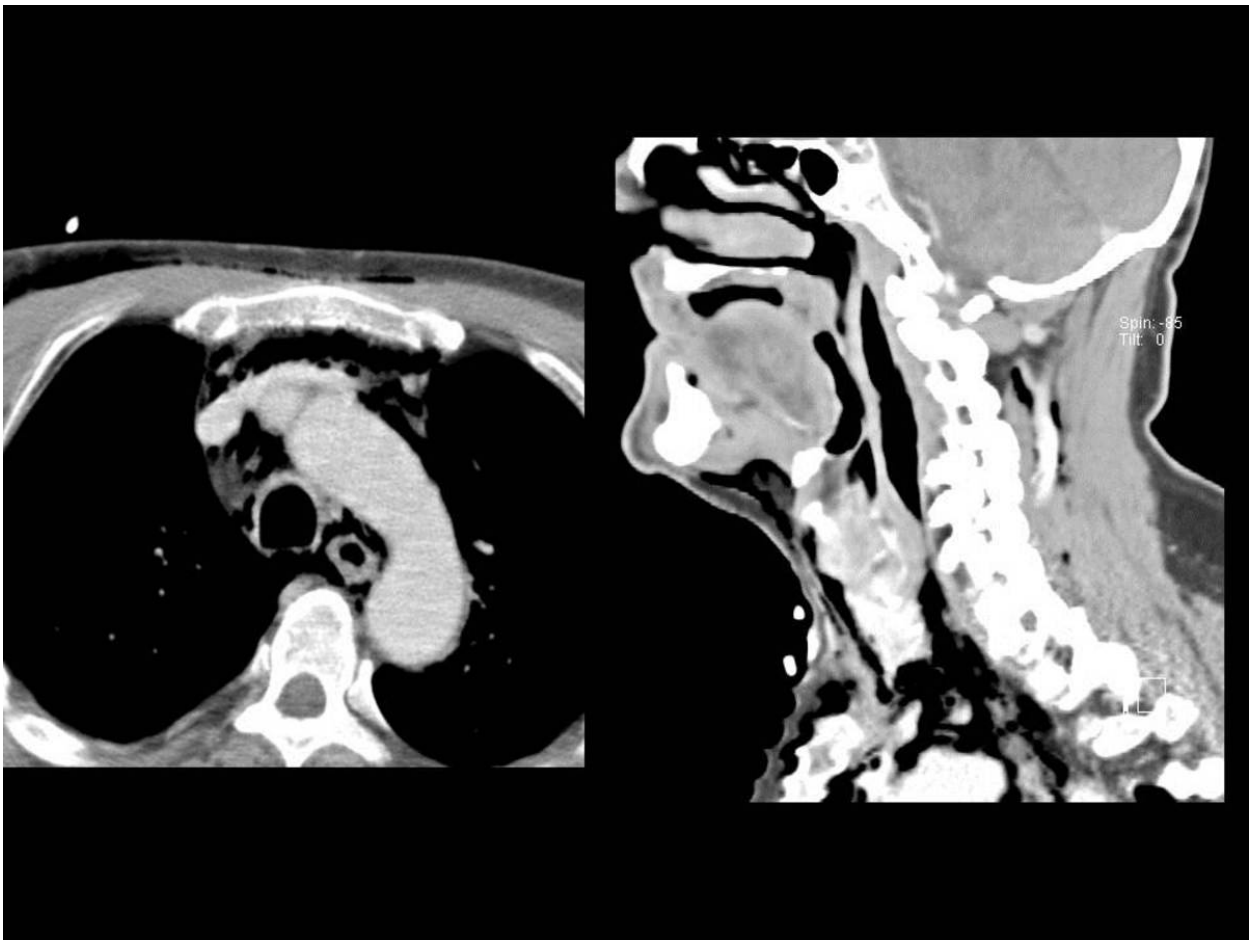

Fig. 25: Retrovisceral/danger space emphysema and pneumomediastinum. Contrast-enhanced computed tomography, sagittal neck and axial thoracic images of the same patient of Fig. 24. Pneumomediastinum (left image). Air present in the retrovisceral space produces mass effect on the pharyngeal lumen (right image).
References: M. L. O. O. Coelho; radioogia, Porto, PORTUGAL

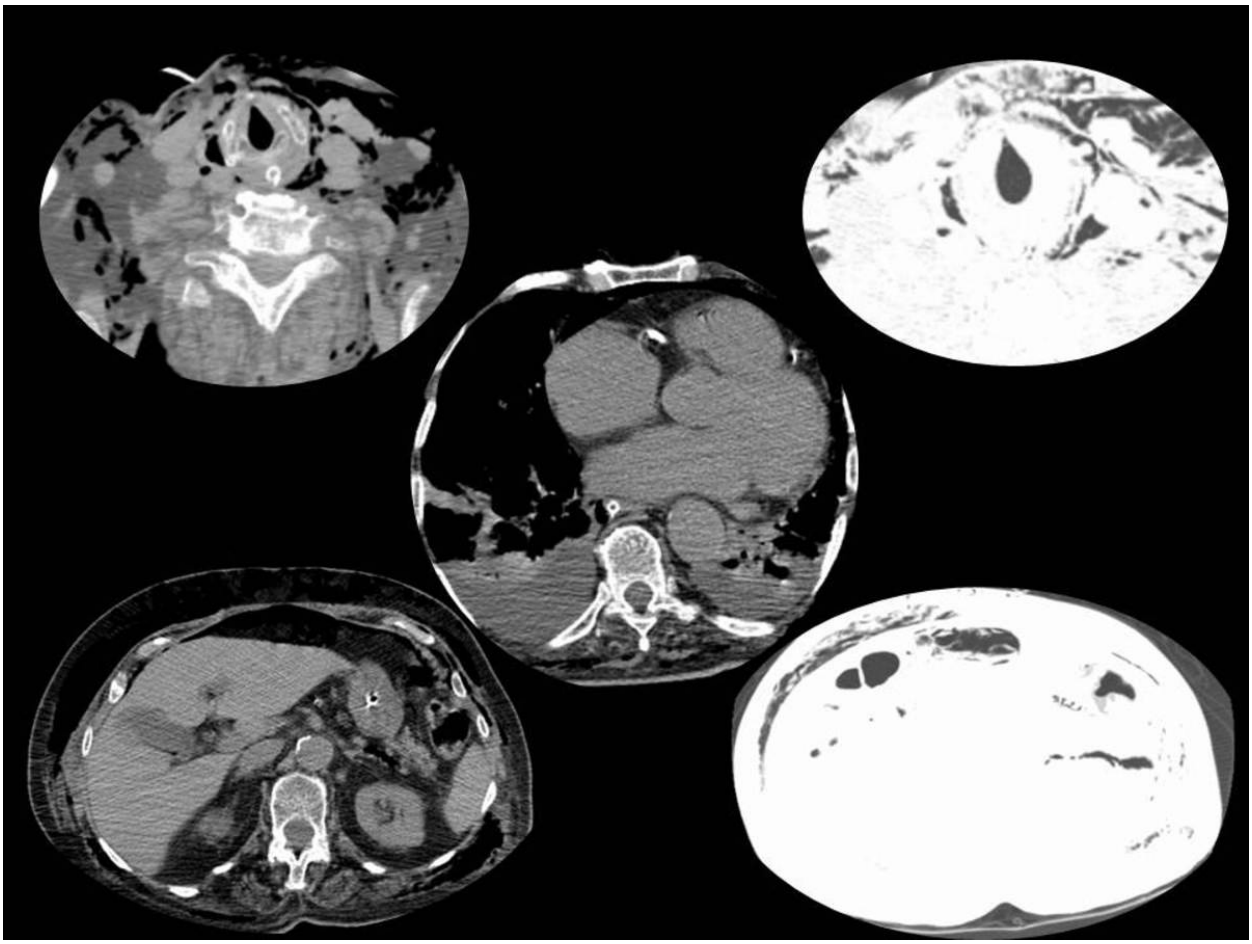

Fig. 26: Retrovisceral/danger space emphysema, pneumomediastinum and retroperitoneum. Neck, thoracic and abdominal axial unenhanced computed tomography images of a 74 year-old man who developed cutaneous emphysema after nasogastric tube intubation.
References: M. L. O. O. Coelho; radioogia, Porto, PORTUGAL

Besides the presence of retropharyngeal air, direct trauma, iatrogenic or not, can result in hematoma, edema or infection.

BENIGN MASSES

Lipoma and hemangioma are the more common primary benign masses of the retropharyngeal space, but as else where, other rare pathologies can occur.

Another common benign finding is the *herniation* of the enlarged thyroid lobes across the fascial free gap between the inferior thyroid artery and the thyroid cartilage oblique line in patients with large goiters.

Lipoma

Lipomas are frequent tumors of the neck, usually presenting at advanced ages. When occuring in the retropharyngeal space, they can become large before clinically apparent.

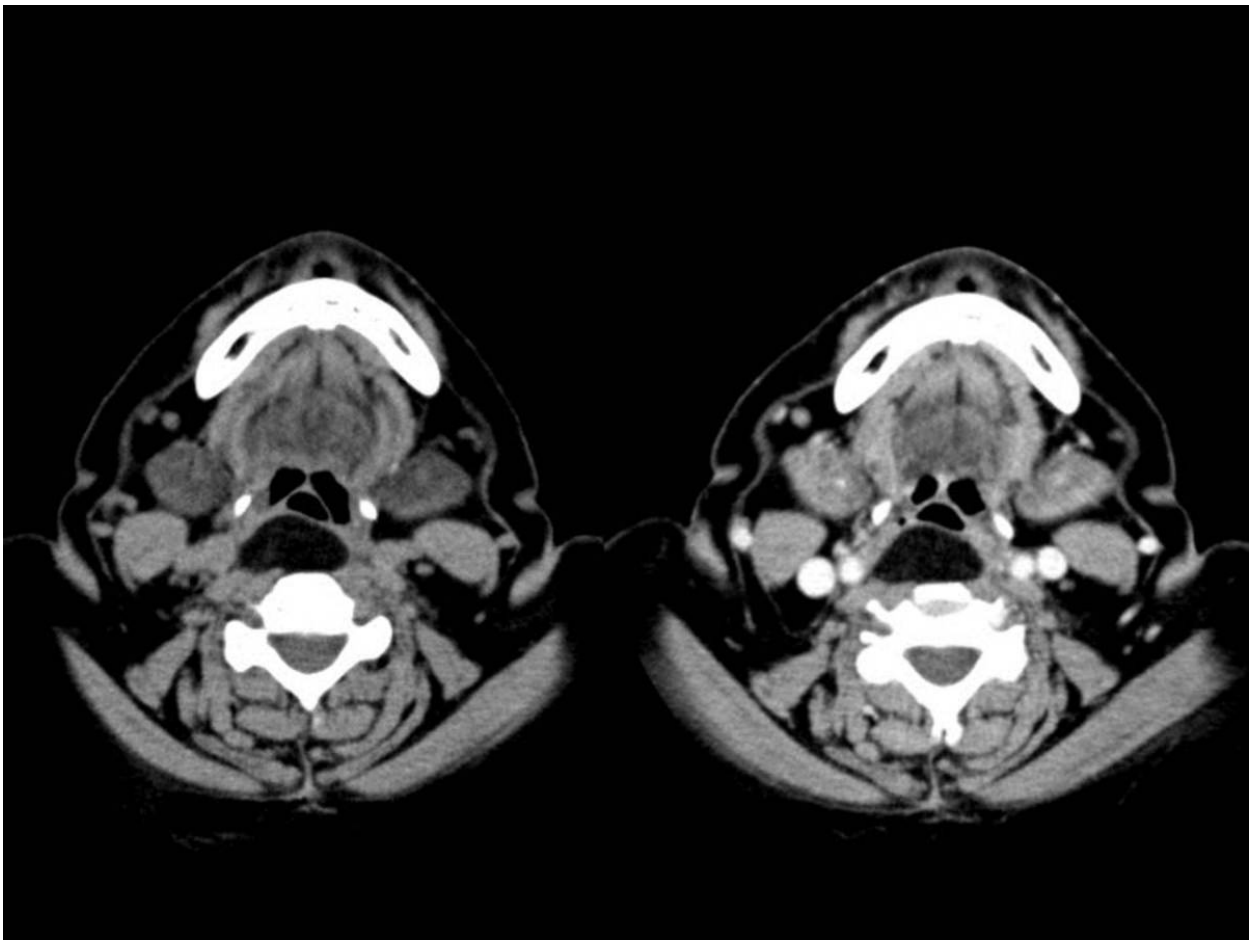

Fig. 27: Retropharyngeal lipoma. Axial computed tomography images of a 63 year-old man presenting with obstructive sleep apnoea, demonstrate a well-defined homogenous fat density mass with thin septa that didn't enhance in the retropharyngeal space. There is no clearly identifiable capsule. The lesion produces mass effect on the airway.
References: M. L. O. O. Coelho; radioogia, Porto, PORTUGAL

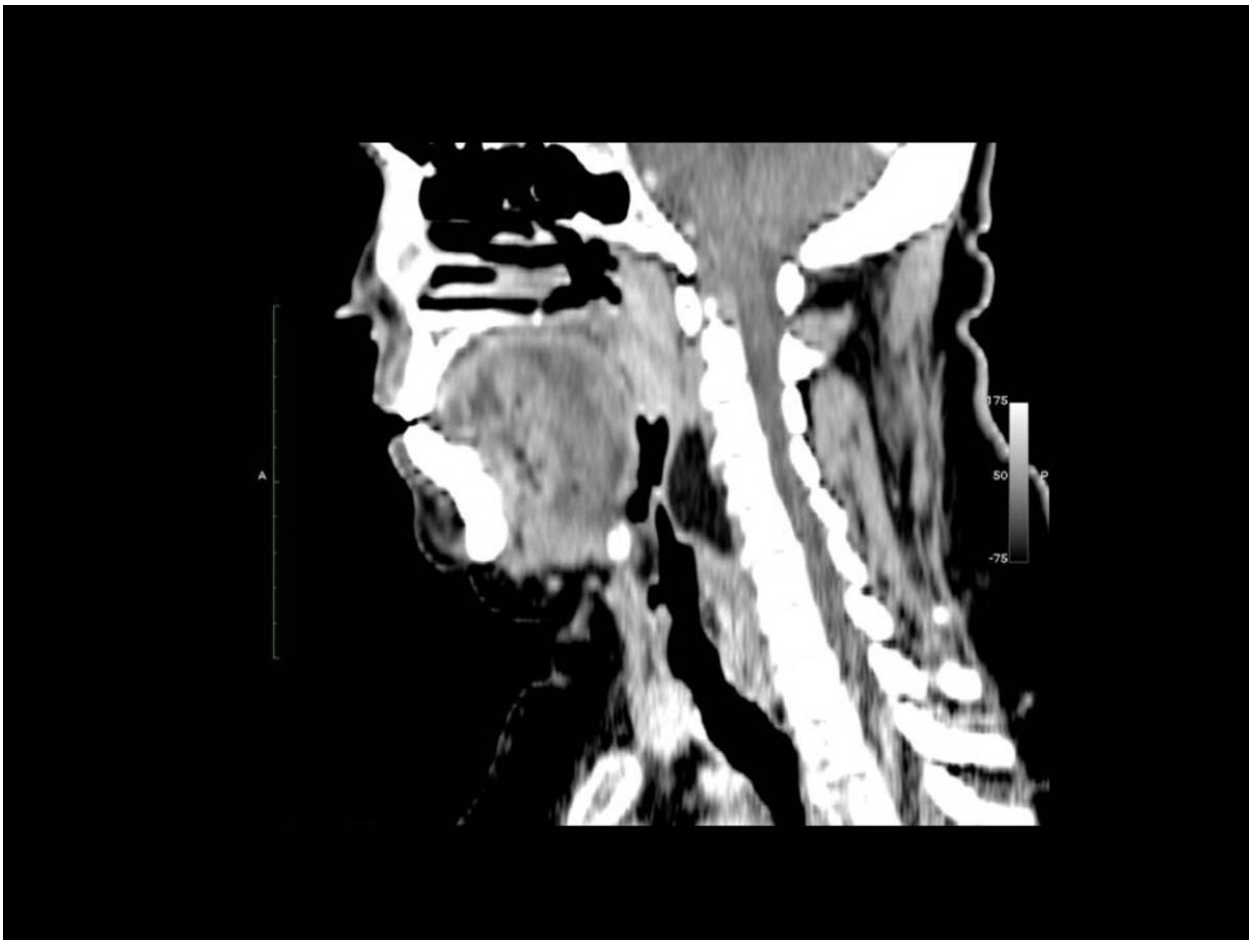

Fig. 28: Retropharyngeal lipoma. Same patient from Fig. 27. The sagital enhanced computed tomography image shows an ovoid homogenous fat mass extending along the retropharyngeal space, producing mass effect on the airway.
References: M. L. O. O. Coelho; radioogia, Porto, PORTUGAL

Hemangioma

Neck hemangiomas are normally deeply located and can involve multiple fascial spaces, reaching large sizes. They can be well defined but also have an infiltrative pattern. This last feature and their dimensions make possible their confusion with malignant neoplams.

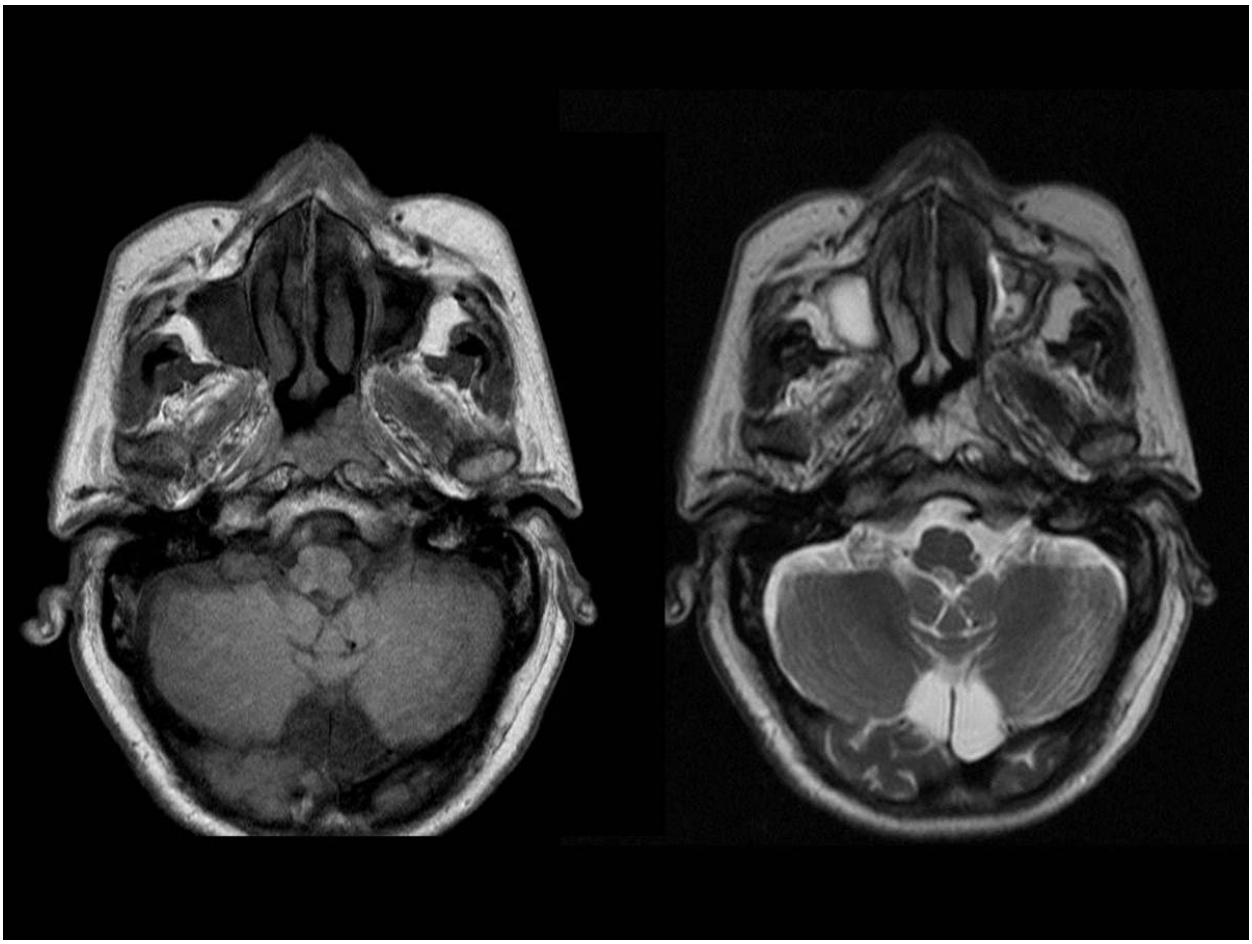

Fig. 29: Nasopharyngeal hemangioma. Male, 74 years old, suspected of having a nasopharyngeal carcinoma. Axial nasopharyngeal FSE MR images show a homogeneous mass, hypointense on T1-weighted (left)and moderately hyperintense on T2-weighted (right) occupying the posterior and left walls of the nasopharynx. The mass blunt the Rosenmüller fossa and appeared to invade the longus capitis and longus colli muscles.
References: M. L. O. O. Coelho; radioogia, Porto, PORTUGAL

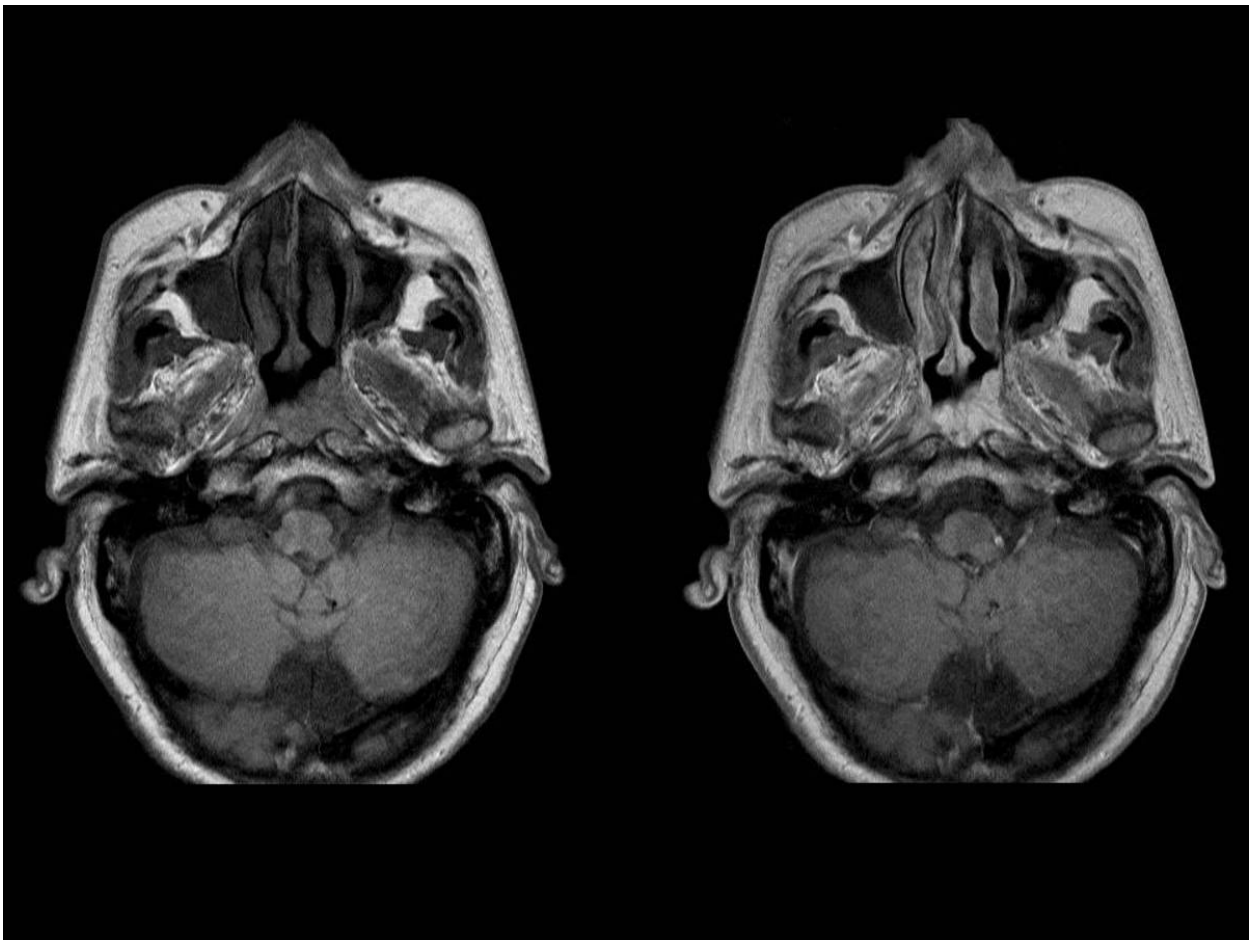

Fig. 30: Nasopharyngeal hemangioma. Same patient from Fig.29. Axial nasopharyngeal FSE MR images, unenhanced (left image) and enhanced (right image) demonstrate that the mass enhances homogeneously. Biopsy confirmed the diagnosis of a was a cavernous hemangioma whichhas remained stable over time.
References: M. L. O. O. Coelho; radioogia, Porto, PORTUGAL

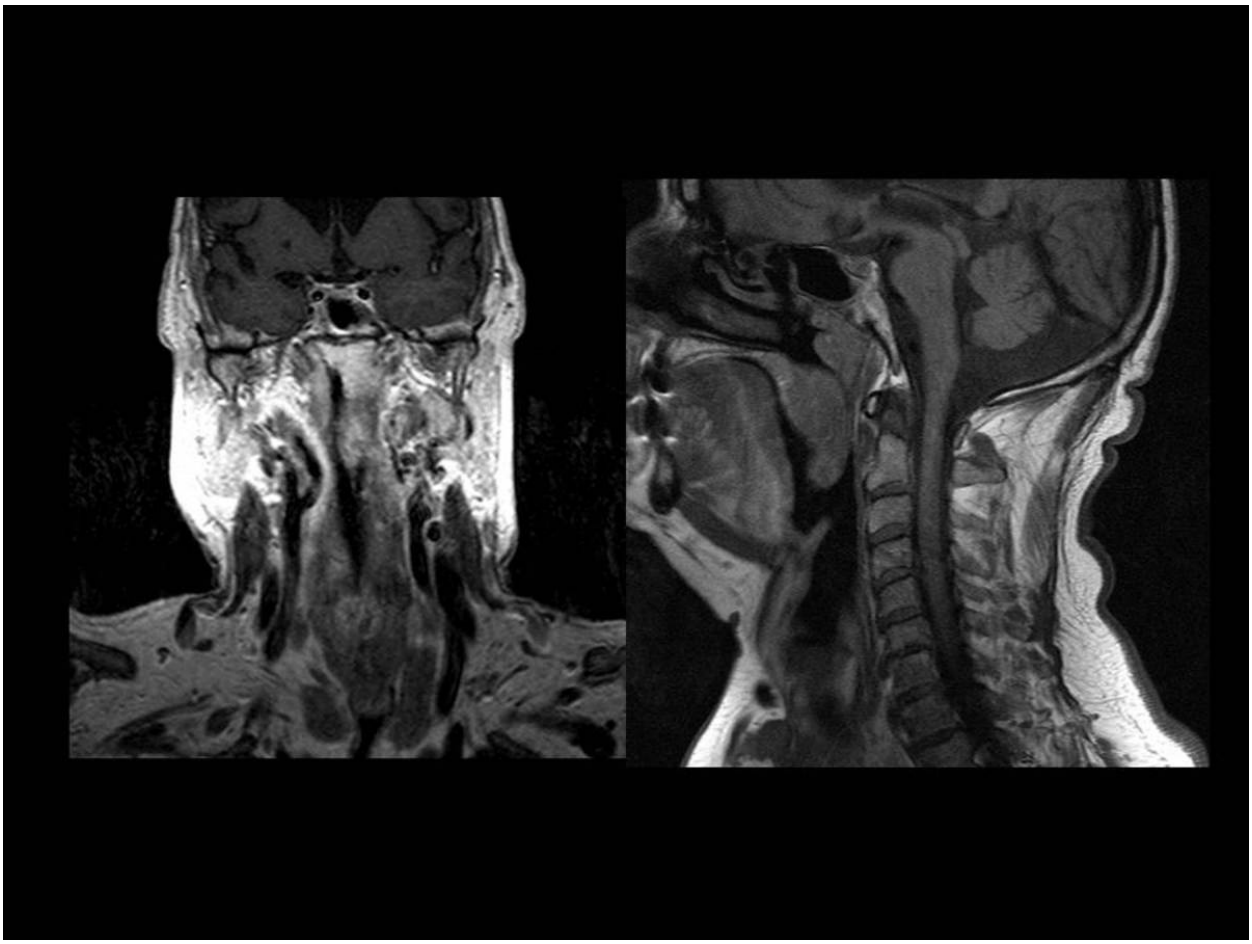

Fig. 31: Nasopharyngeal hemangioma. Same patient from Fig.29. Coronal enhanced T1-weighted image and sagittal unenhanced T1 weighted image: the homogenously enhancing mass occupies the cavum and contacts the cortical bone of the skull base.
References: M. L. O. O. Coelho; radioogia, Porto, PORTUGAL

Rare entities: Nodular fasciitis

Nodular fasciitis is a benign, tumour-like proliferation of fibroblasts and myofibroblasts, and may be mistaken for a sarcomatous lesion due to its rapid growth and pseudosarcomatous histologic features. Its pathogenesis is unknown and it usually occurs between 20 and 40 years, affecting equally both genders. Fewer than 20% of lesions occur before 20 years. It usually presents as a subcutaneous (most frequent), intramuscular or fascial, solitary, rapidly growing mass. Nearly 50% are found in the upper extremity. Head and neck lesions represent 18% of all lesions.

Fig. 32: Nodular fasciitis. A 10-year-old female patient presented with sneezing, obstructive sleep apnoea and a right lateral cervical mass, which had enlarged in the past four months. The patient denied pain, dysphonia or dysphagia. Lateral cervical spine X-ray depicts anterior convex bowing of the air column produced by a soft tissue mass. Acknowledgment to the Department of Radiology of the Hospital Pediátrico de Coimbra.
References: M. L. O. O. Coelho; radioogia, Porto, PORTUGAL

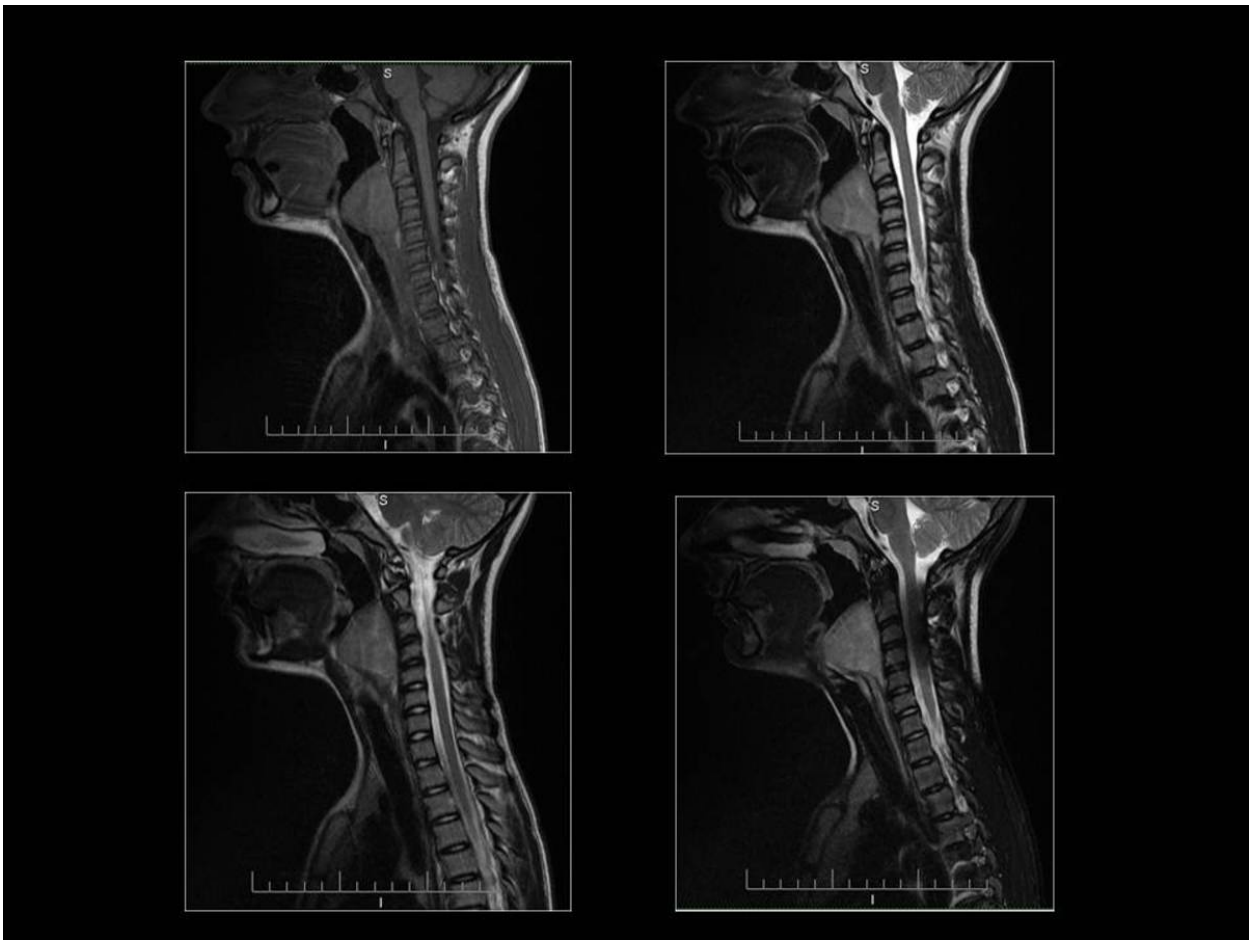

Fig. 34: Nodular fasciitis. Same patient from Fig.32. Sagittal cervical FSE T1WI (left superior image). The oval retropharyngeal mass displayed intermediate SI in T1WI. It presented with regular borders and showed no signs of invasion of the cervical spine. Sagittal cervical FSE T2-weighted MR images. The mass had high signal intensity on T2WI. The posterior pharyngeal mucosa was displaced anteriorly by the mass but showed no clear signs of invasion. Acknowledgment to the Department of Radiology of the Hospital Pediátrico de Coimbra.

References: M. L. O. O. Coelho; radioogia, Porto, PORTUGAL

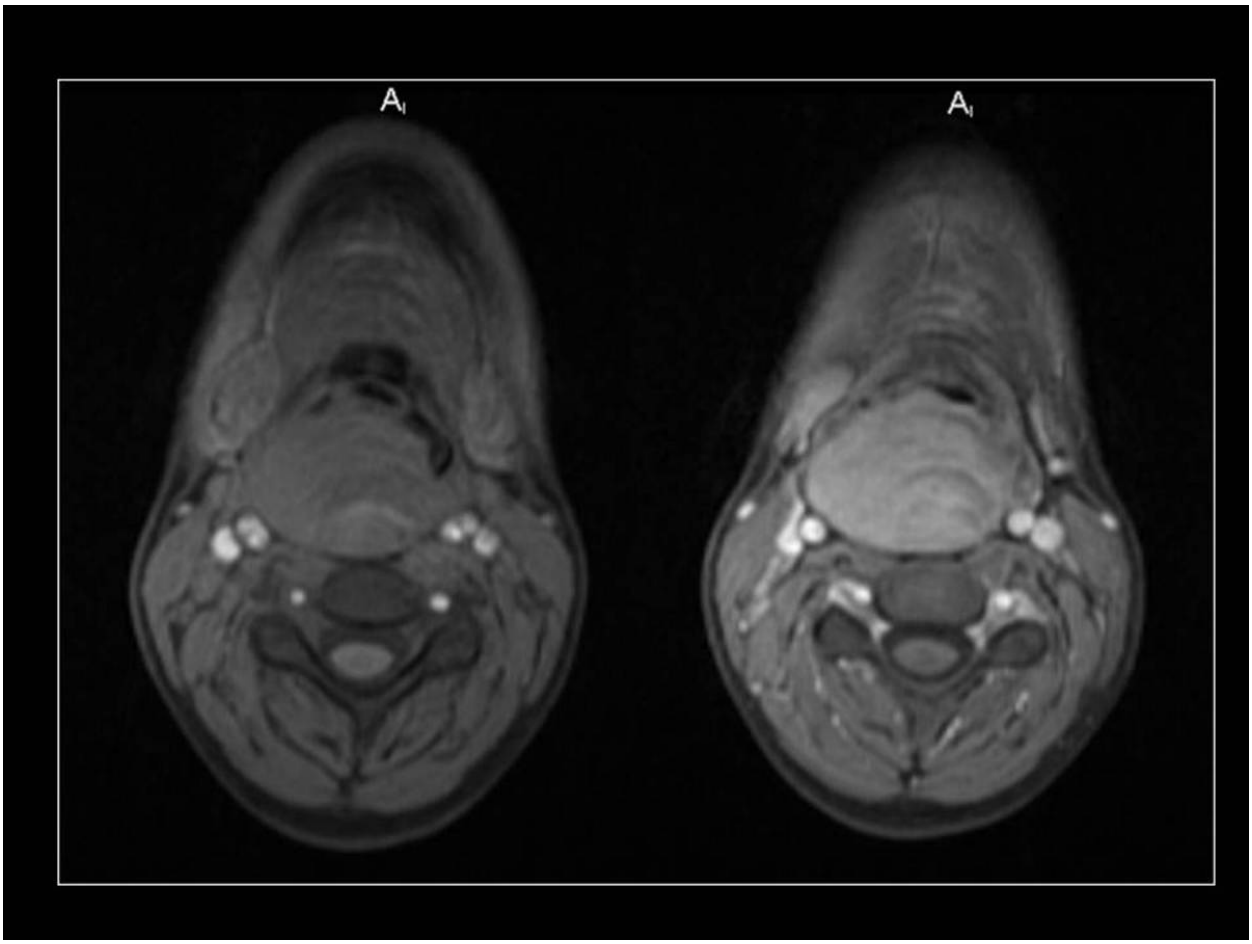

Fig. 35: Nodular fasciitis. Same patient from Fig.32. Axial GRE FS T1-weighted pre (left) and post-contrast (right) MR images. The mass did not show a SI loss on FS images, thus excluding the presence of macroscopic fat, and displayed a heterogeneous enhancement after IV contrast. Acknowledgment to the Department of Radiology of the Hospital Pediátrico de Coimbra.
References: M. L. O. O. Coelho; radioogia, Porto, PORTUGAL

Goiter

Because of the fascial anatomy, a large goiter can reach the retrovisceral space (crossing the fascial gap between the inferior thyroid artery and the oblique thyroid catilage line) and extend behind the esophagus, growing either upward as a retropharyngeal mass or downward as a retroesophageal mass.

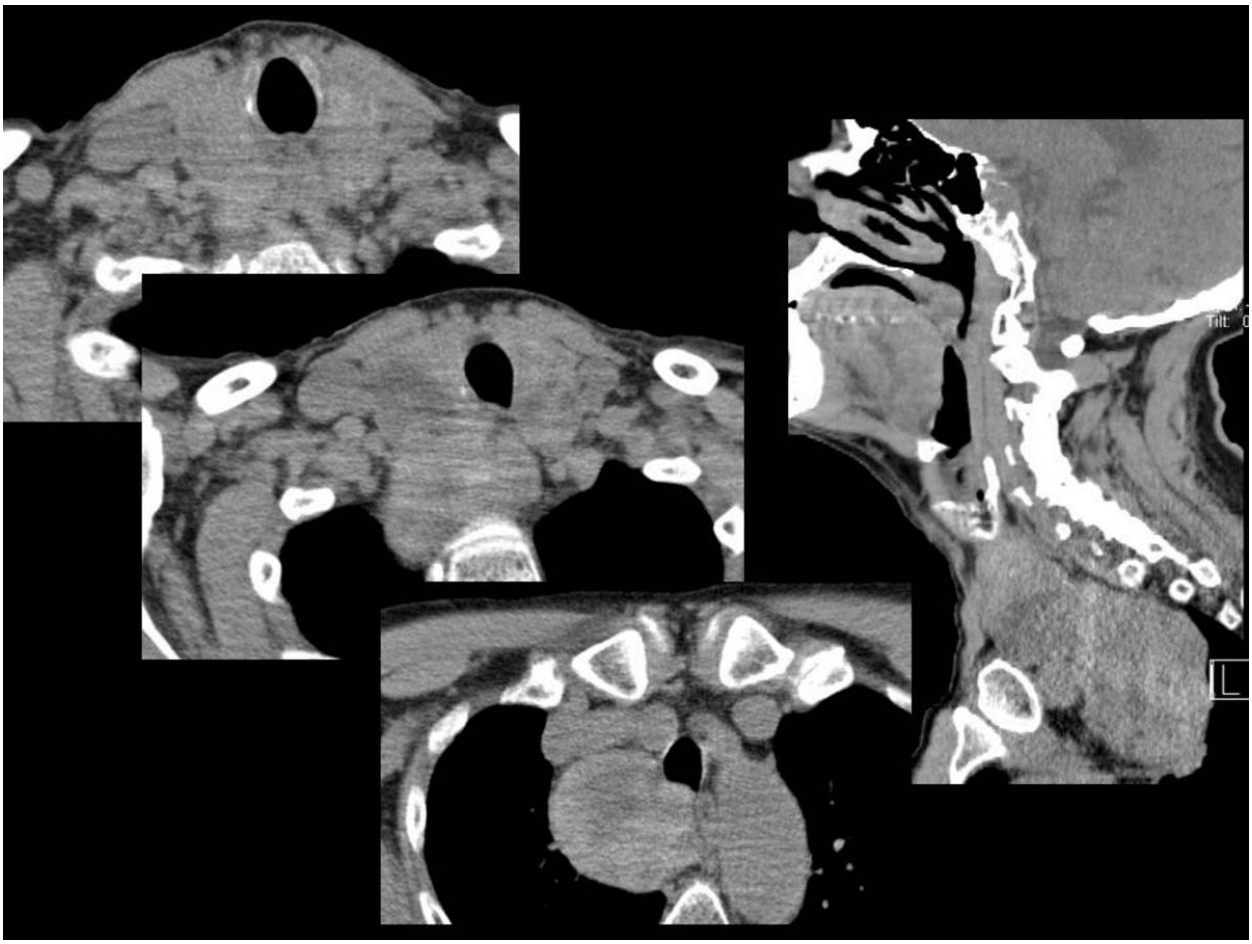

Fig. 36: Goiter. Axial and sagital unenhanced computed tomography images of a 70 year-old woman. A large goiter crosses posteriorly to the retrovisceral space and from there extends downwards in the posterior mediastinum. Note it produces mass effect, displacing anteriorly the larynx, the trachea and the grat vessels.
References: M. L. O. O. Coelho; radioogia, Porto, PORTUGAL

MALIGNANT MASSES

Common malignancies affecting retrovisceral space are pharyngeal, esophageal and thyroid tumors and lymphoma. The visceral fascia around the pharyngeal constrictor muscles and at lesser extent the alar fascia can sometimes and for some long contain the tumor, but eventually it ends spreading, reaching other spaces, including the danger space.

Squamous cell carcinoma of the pharynx

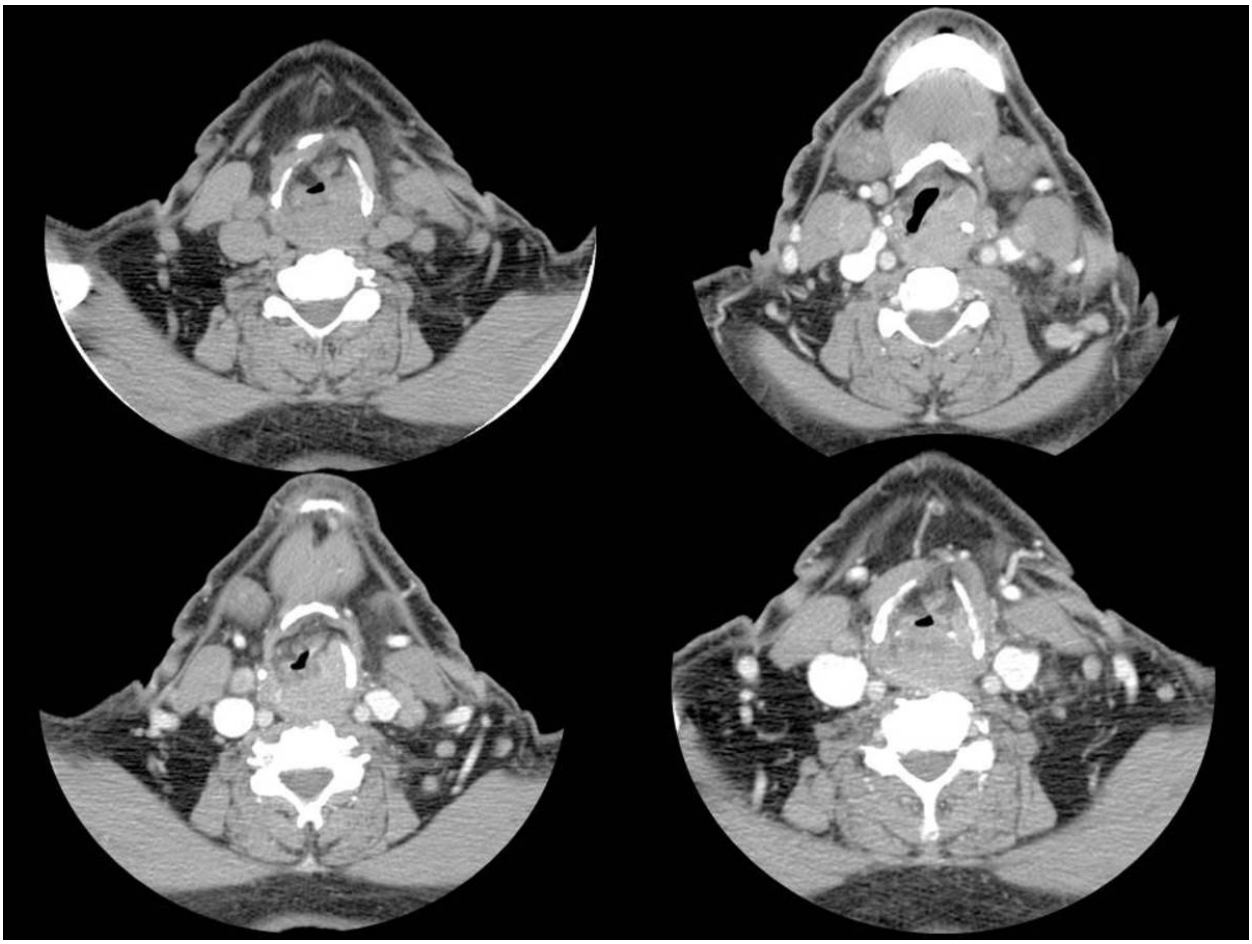

Fig. 37: Squamous cell carcinoma of the pharynx. Axial unenhanced and enhanced computed tomography images at the level of the hypopharynx demonstrate a extensive infiltrative lesion centered in the left pyriform sinus that crosses along the lateral pharyngeal wall and invades the retropharyngeal fat. The lesion also crosses the left pharyngo-epiglottic fold and invades the parapharyngeal space. The danger space probably is also infiltrated, although invasion of the prevertebral muscles is not clearly depicted. This lesion produces mass effect on the airway and shows moderate contrat enhancement. There are several adenopathies: at the left a cluster invades the internal jugular vein; at the right the vein is only slightly compressed. Acknowledgment to the Department of Neuroradiology of the Centro Hospitalar do Porto.
References: M. L. O. O. Coelho; radioogia, Porto, PORTUGAL

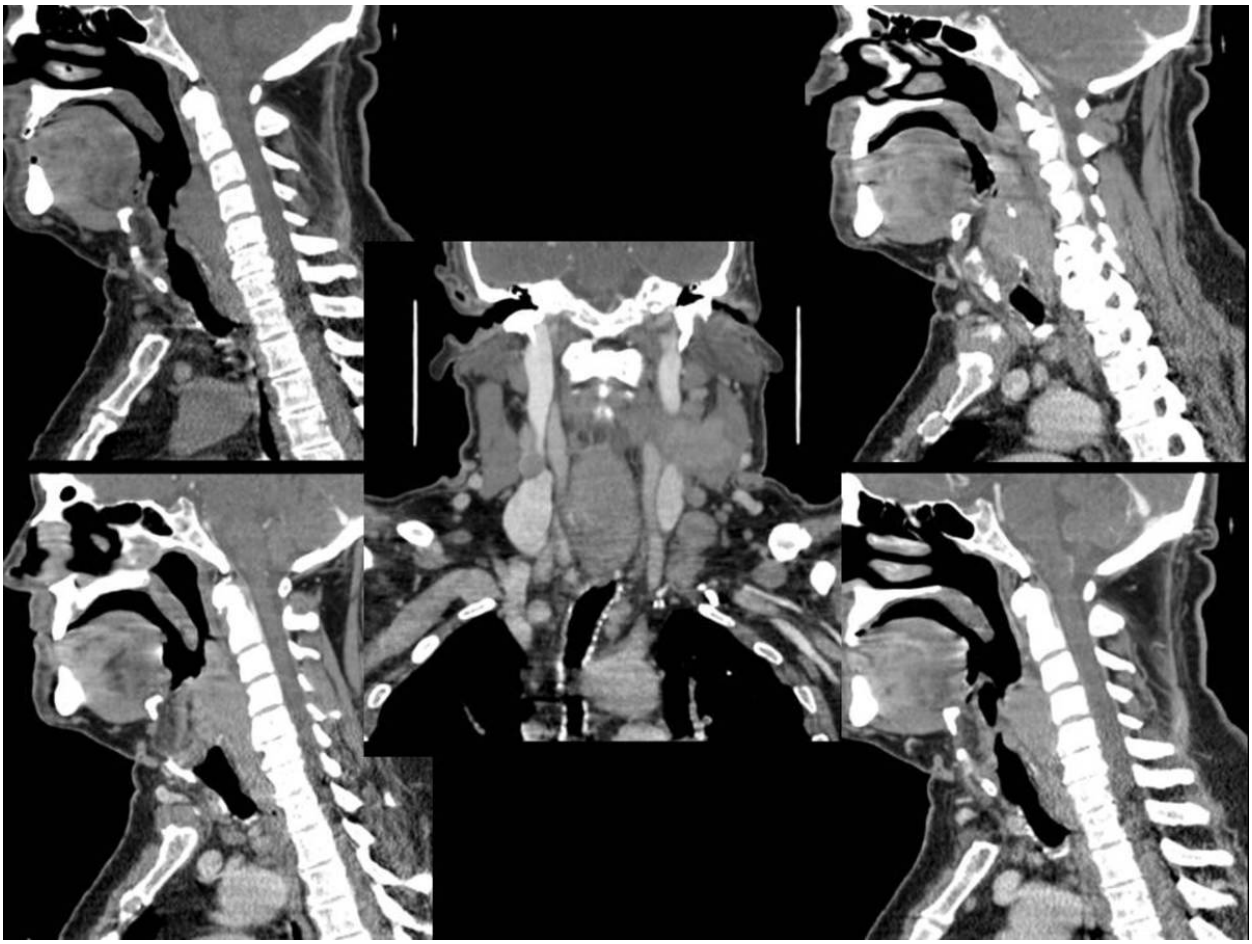

Fig. 38: Squamous cell carcinoma of the pharynx. Same patient from Fig. 37. Sagital and coronal computed tomography images show the posterior extension of the tumor along the retrovisceral and danger spaces and better depict the mass effect that this lesion produces on the airway. Note also the mass effect produced by bilateral adenopathies on the internal jugular veins. Acknowledgment to the Department of Neuroradiology of the Centro Hospitalar do Porto.
References: M. L. O. O. Coelho; radioogia, Porto, PORTUGAL

Undifferentiated carcinoma of the nasopharynx

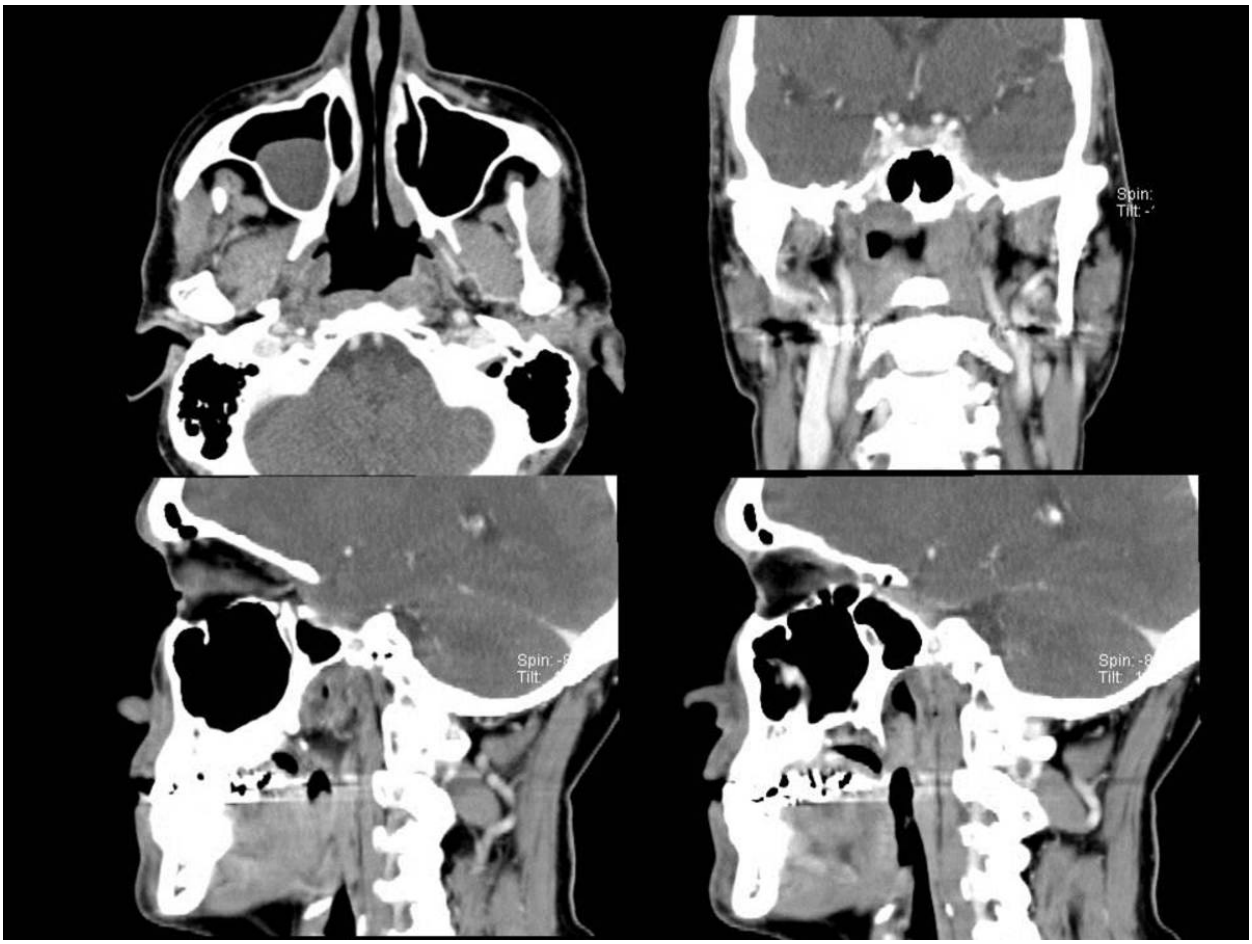

Fig. 39: Undifferentiated carcinoma of the nasopharynx. Axial, coronal and sagital computed tomography images at the level of nasopharynx of a 50 year-old man with an isoattenuating mass occupying the left and part of the posterior walls of the nasopharynx. The mass blunts the left Rosenmüller fossa.
References: M. L. O. O. Coelho; radioogia, Porto, PORTUGAL

Anaplastic thyroid tumor

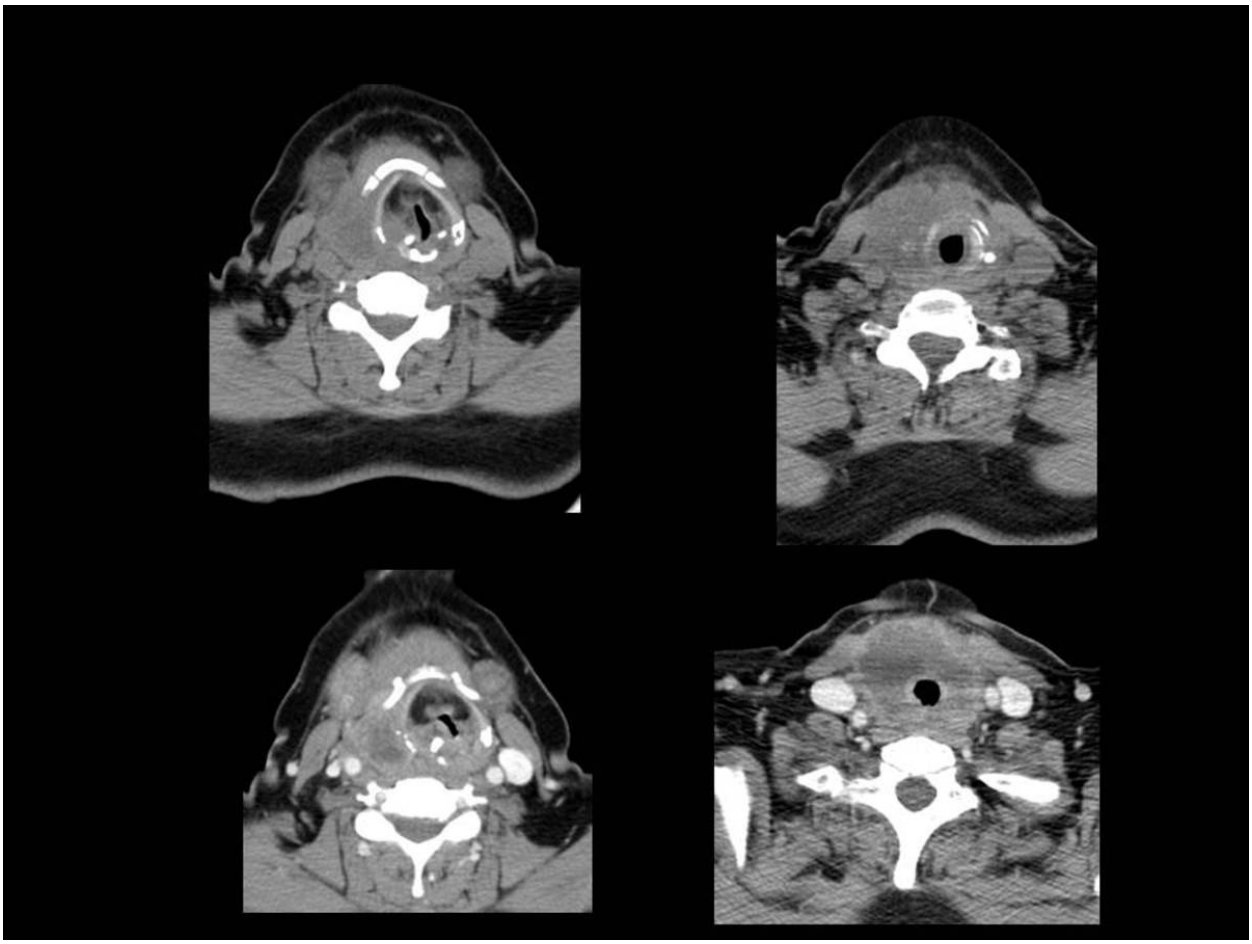

Fig. 40: Anaplastic thyroid tumor. Axial unenhanced (superior) and contrast-enhanced (inferior) CT scan images through the lower neck. Unehnanced images show an heterogeneous tissue replacing and expanding the thyroid gland, with some foci of calcifications inside. After contrast injection, the lesion enhances at the periphery, and the center remains hypoattenuating, suggesting necrosis. The mass has displaced the larynx to the left, invaded it and partly destroyed its cartilage. In fact, this lesion infiltrated all the visceral compartment, the right parapharyngeal space, the danger and the prevertebral spaces, as all involved fat planes are obliterated. All these imaging findings provide evidence of the aggressive nature of this anaplastic thyroid carcinoma as it violates the fascial planes. Acknowledgment to the Department of Neuroradiology of the Centro Hospitalar do Porto.
References: M. L. O. O. Coelho; radioogia, Porto, PORTUGAL

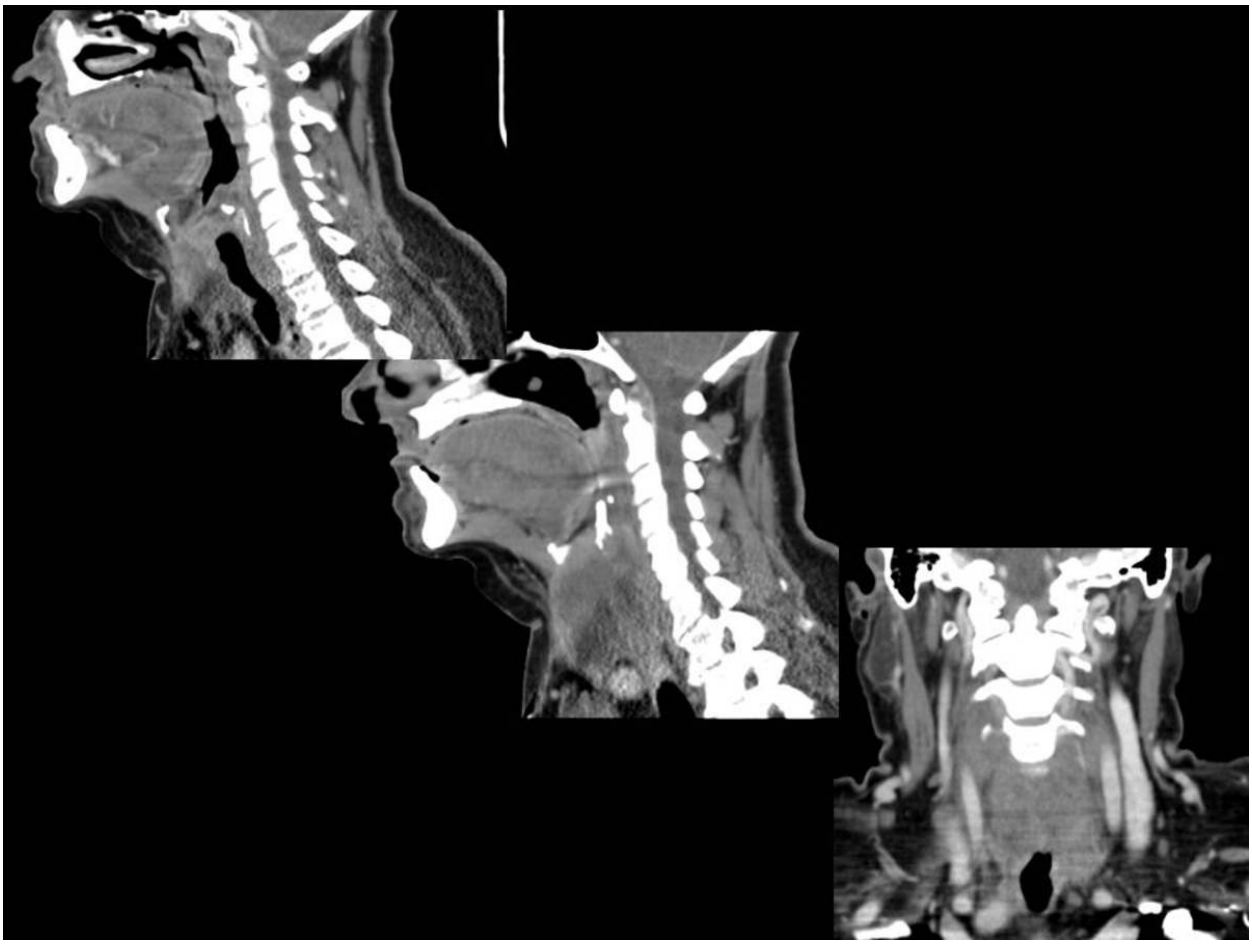

Fig. 41: Anaplastic thyroid carcinoma Sagittal and coronal contrast-enhanced CT scan images of the same patient from Fig. 40, clearly depicts the invasion of the entire infra-hyoid visceral compartment. There are also no fat planes between it and the prevertebral muscles, meaning infiltration of the danger and prevertebral muscles. Note the thyroid cartilage invasion (middle image). Acknowledgment to the Department of Neuroradiology of the Centro Hospitalar do Porto.
References: M. L. O. O. Coelho; radioogia, Porto, PORTUGAL

Neoplastic lymphadenopathy, especially from advanced maxillary sinus, oropharyngeal, and hypopharyngeal carcinoma can involve the retropharyngeal space.

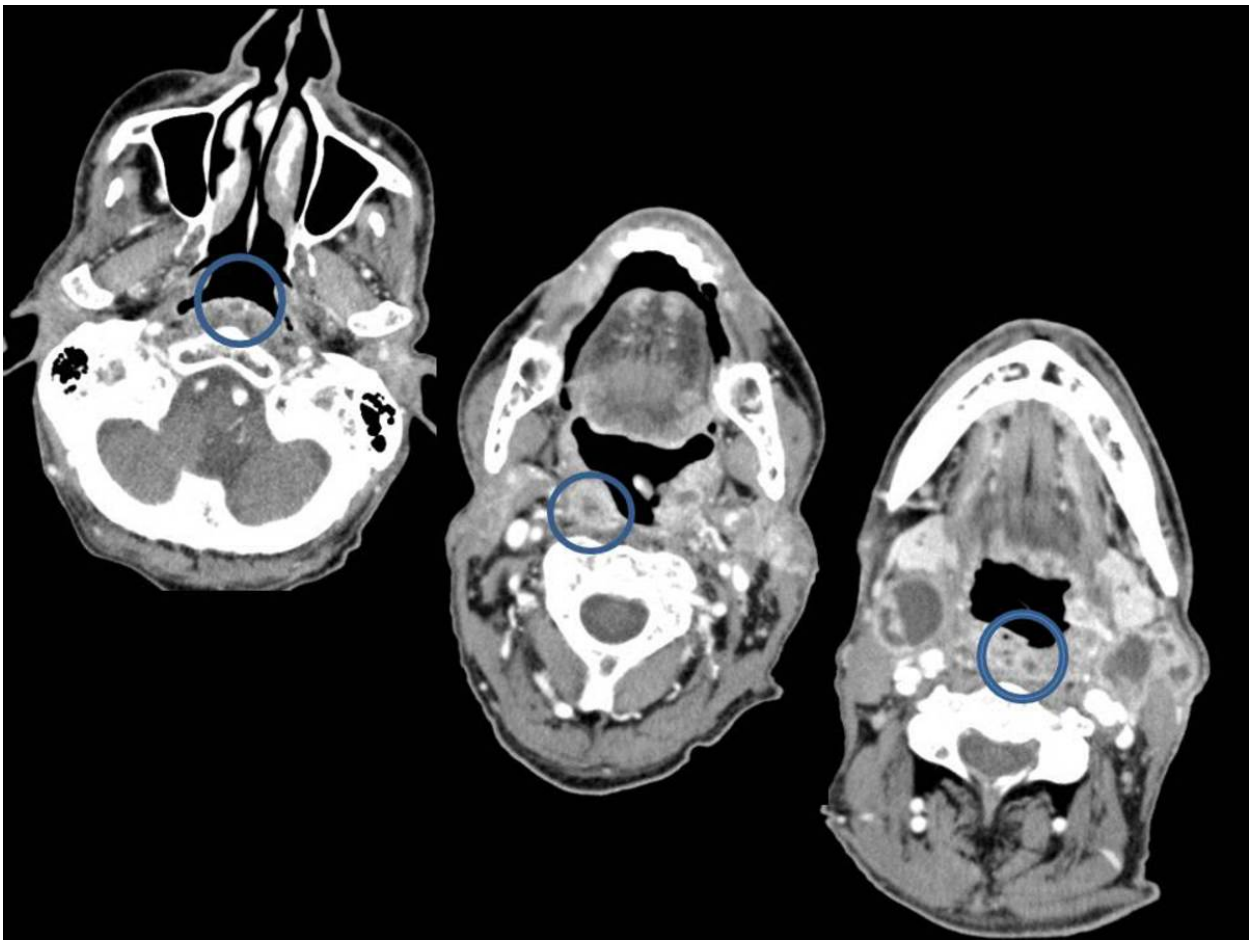

Fig. 42: Metastatic adenopathy from a tonsilar carcinoma. Axial enhanced computed images: -left image: retropharyngeal node with central hypodensity and peripheral enhancement - necrotic lymphadenopathy. - middle image: large, necrotic right lateral retropharyngeal lymph node with irregular enhancing margins, surrounded by increased attenuation fat - extracapsular lymphadenopathy. - right image: retropharyngeal necrotic lymph node cluster.
References: M. L. O. O. Coelho; radioogia, Porto, PORTUGAL

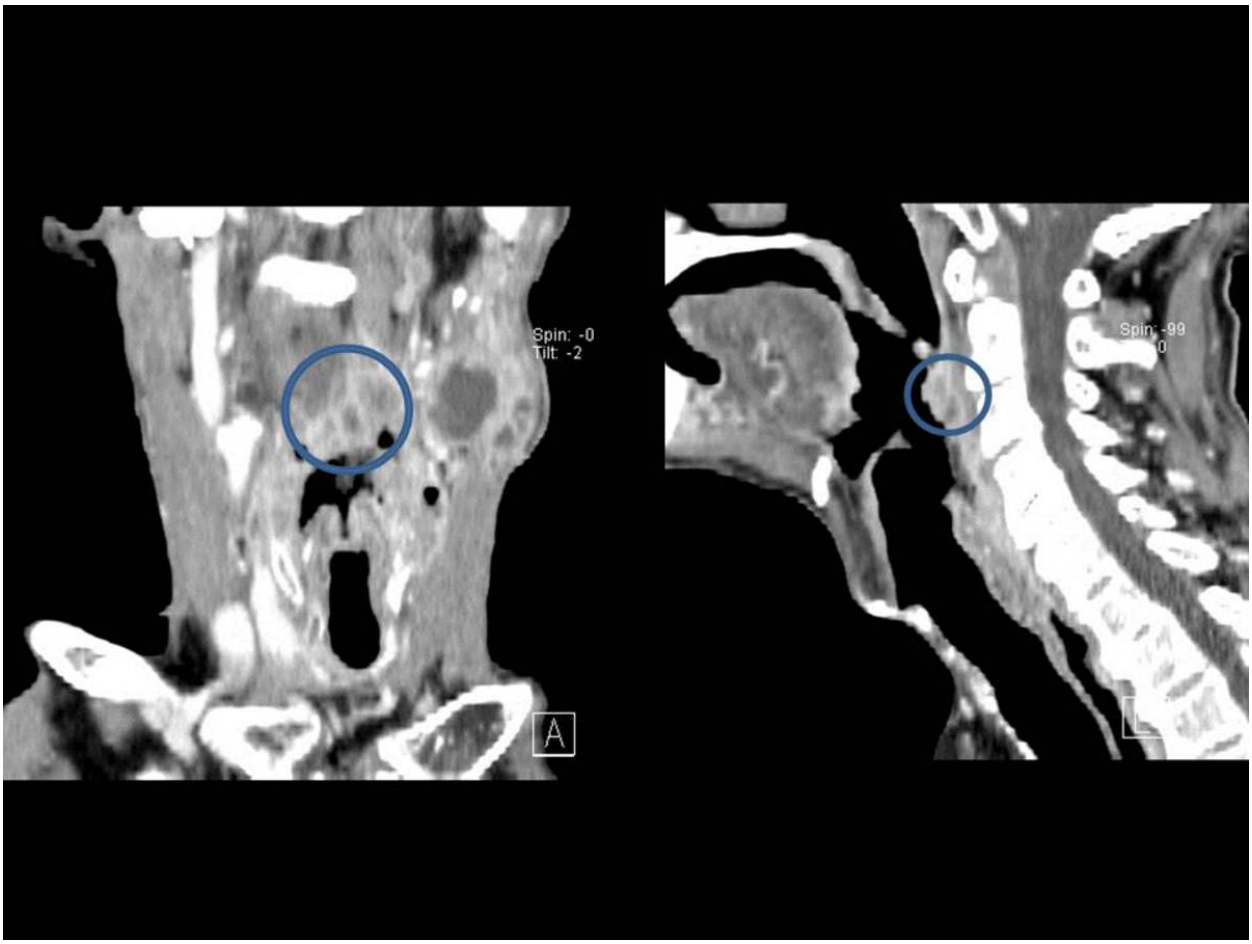

Fig. 43: Metastatic adenopathy from a tonsilar carcinoma. Coronal and sagital enhanced computed tomography images of the same patient of Fig. 36 showing the retropharyngeal necrotic lymph node cluster.
References: M. L. O. O. Coelho; radioogia, Porto, PORTUGAL

Images for this section:

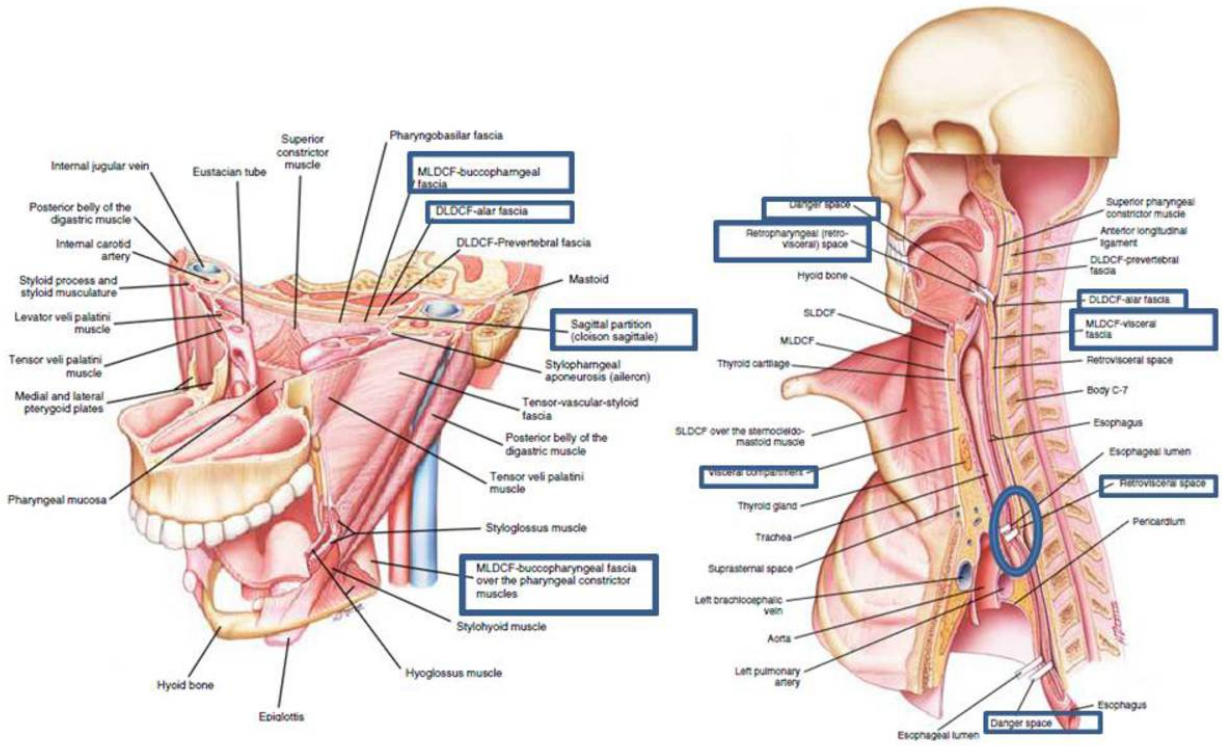

Fig. 1: Depicted relationships of the fascia and visceral compartment to other spaces and the mediastinal structures. Blue circumference: alar fascia and visceral fascia fusion, obliterating the retrovisceral space at the middle mediastinum. Adapted from Som PM (2003) Head and Neck Imaging

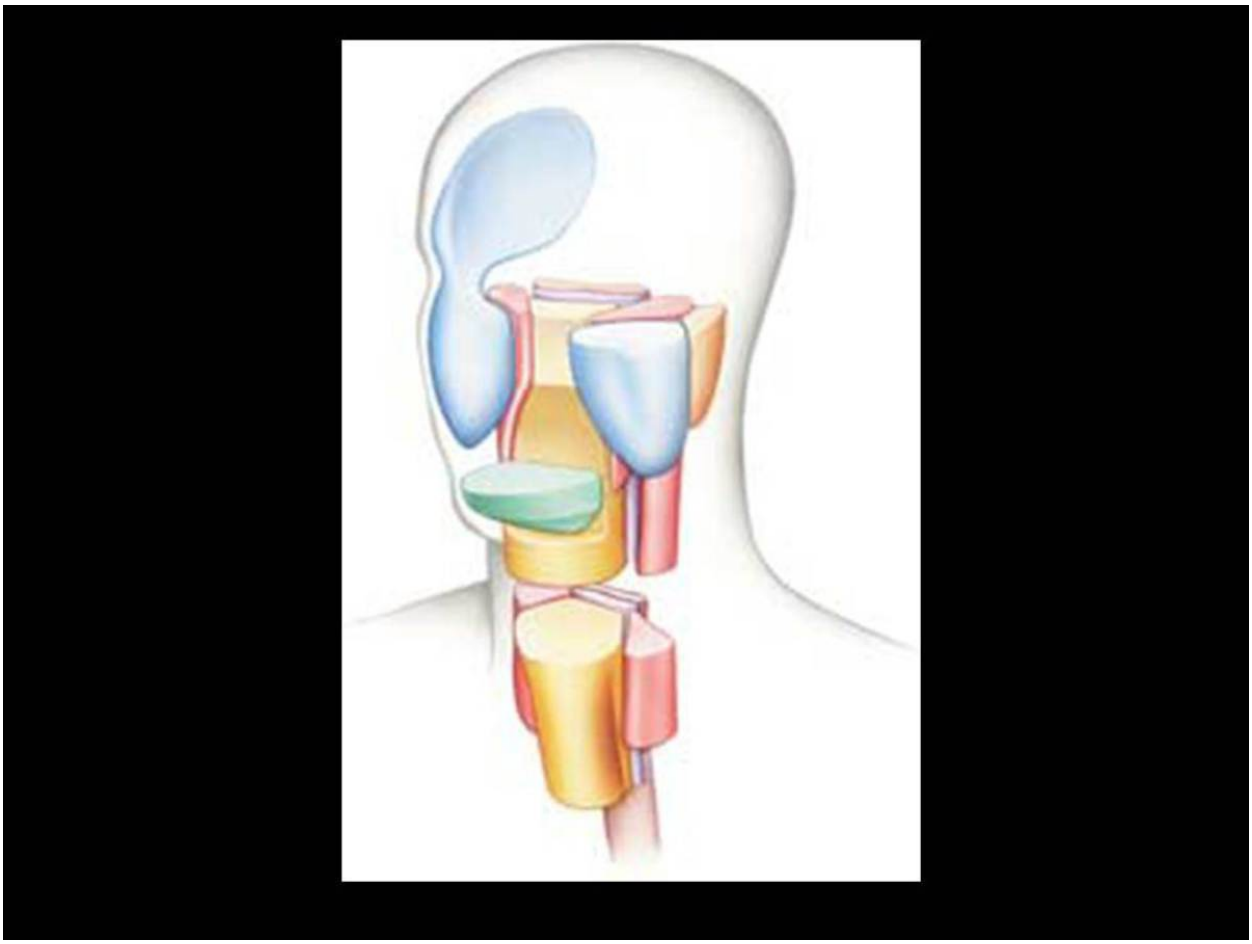

Fig. 3: Block diagram showing the relationships of the visceral compartment (yellow) with the parapharyngeal spaces and the carotid sheaths (pink), the submandibular space (green), the masticator spaces (blue) and the danger space (violet).

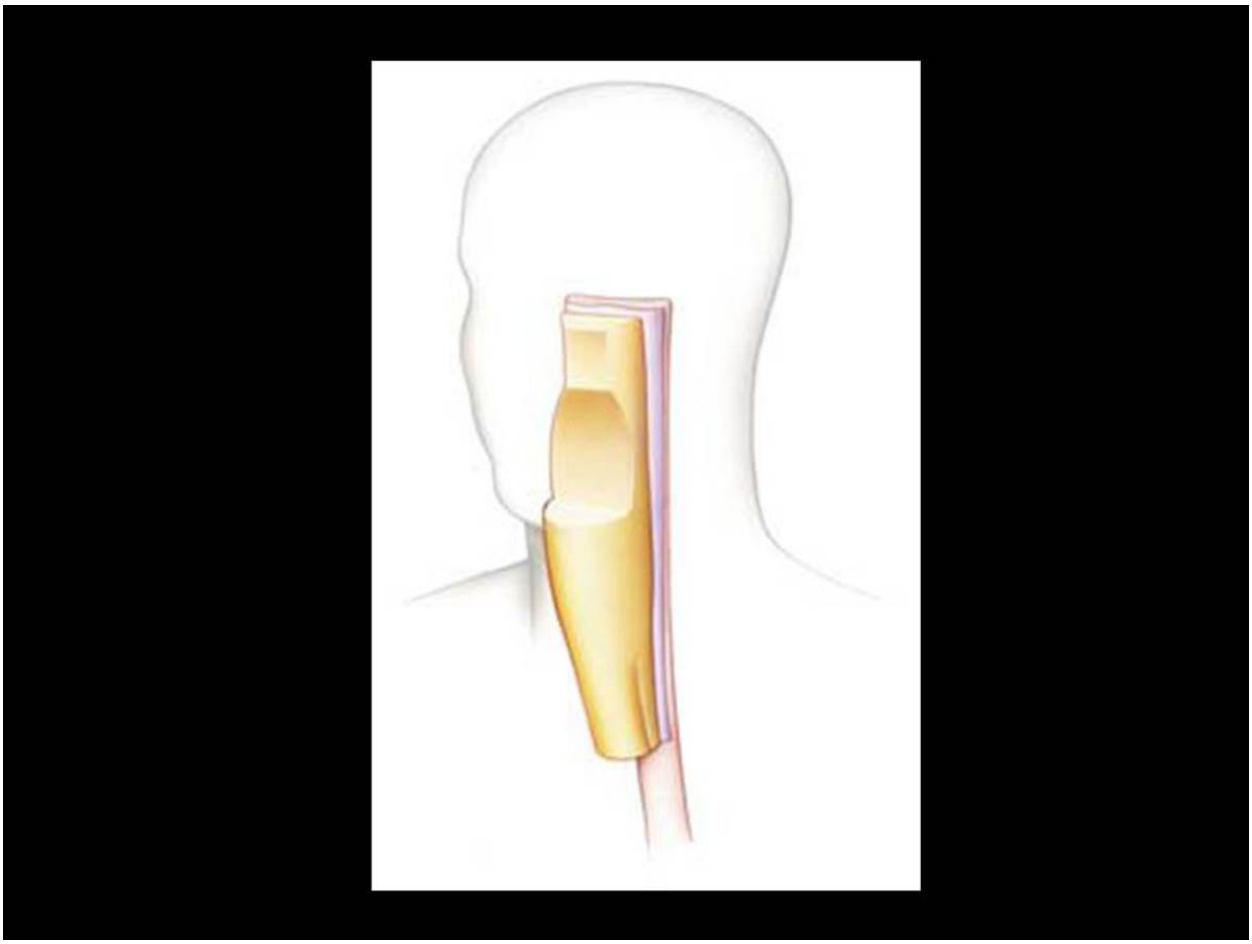

Fig. 2: Visceral compartment block diagram (yellow). Note that the pretracheal space begins at hyoid bone, whereas the retrovisceral begins at skull base. The division of the visceral compartment into the pretracheal space and the retrovisceral space by the fascia that accompanies the inferior thyroid artery is shown as a cleft in the visceral compartment. The pretracheal space extends substernally, while the retrovisceral space extends to about the level of the carina.

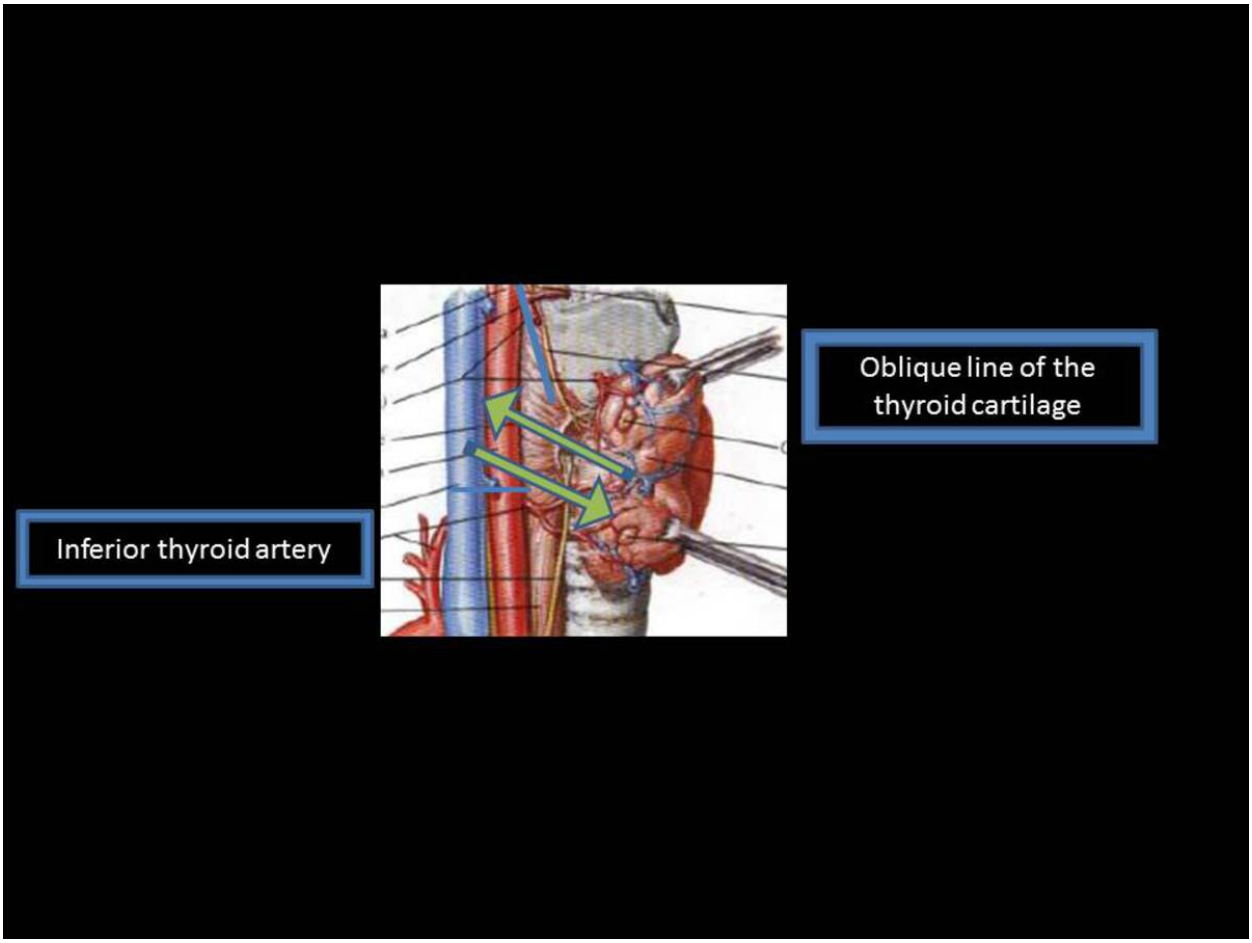

Fig. 4: Limits of the free communication between pretracheal and retrovisceral spaces. Adapted from Netter et all, Atlas of Normal Anatomy.

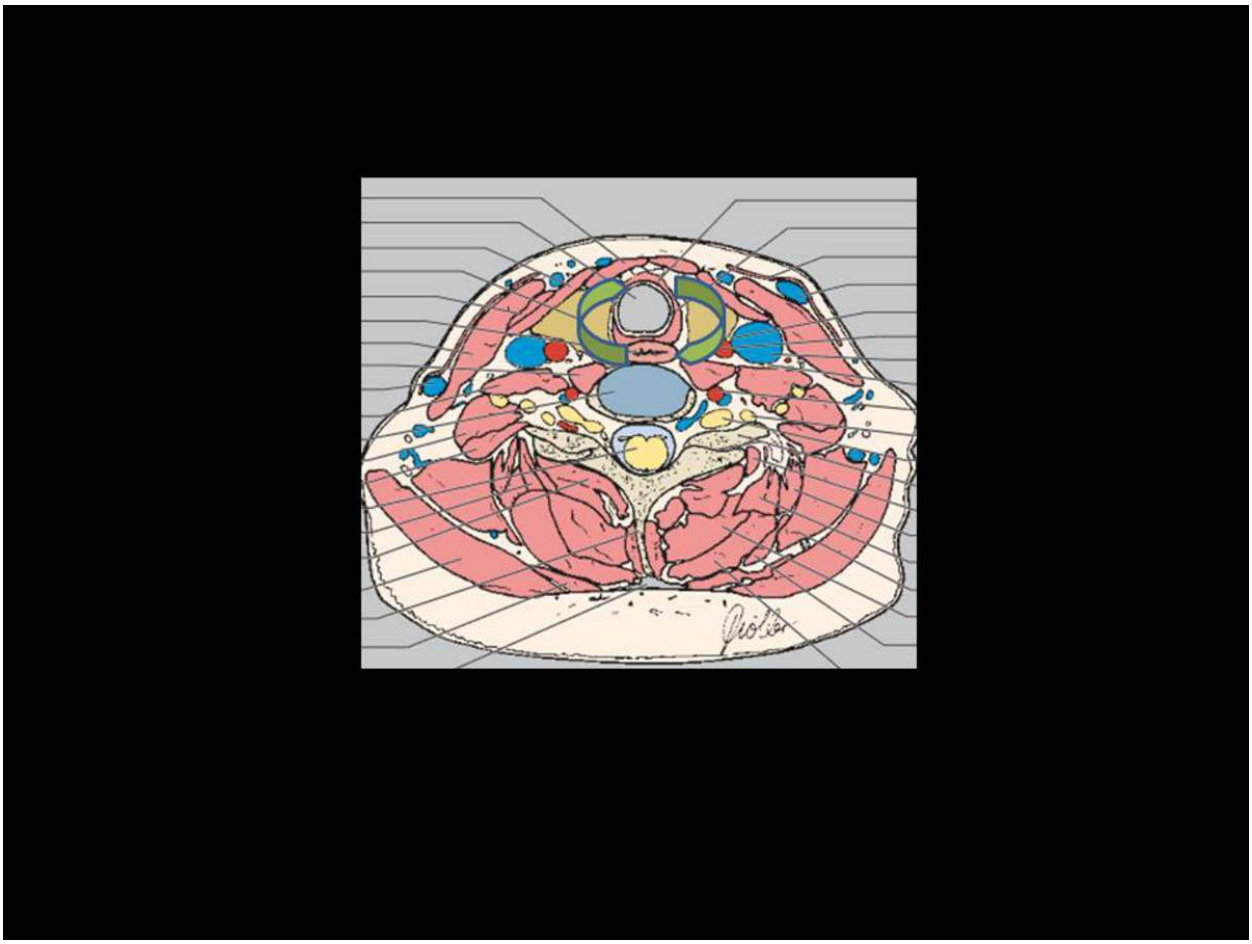

Fig. 5: Free communication around the sides of esophagus and thyroid gland - between the levels of the oblique line of the thyroid cartilage and inferior thyroid artery - between the spaces of the visceral compartment. Adapted from: Moeller TB, Reif E (2007) Pocket of Sectional Anatomy, Computed Tomography and Magnetic Resonance Imaging, Volume I: Head and Neck

Fig. 6: Blue circumference: fascia that accompanies the inferior thyroid artery, and divides caudally the pretracheal from the retrovisceral (retroesophageal)space. Adapted from Som PM (2003) Head and Neck Imaging

Fig. 7: Block diagram of the danger and the prevertebral spaces.

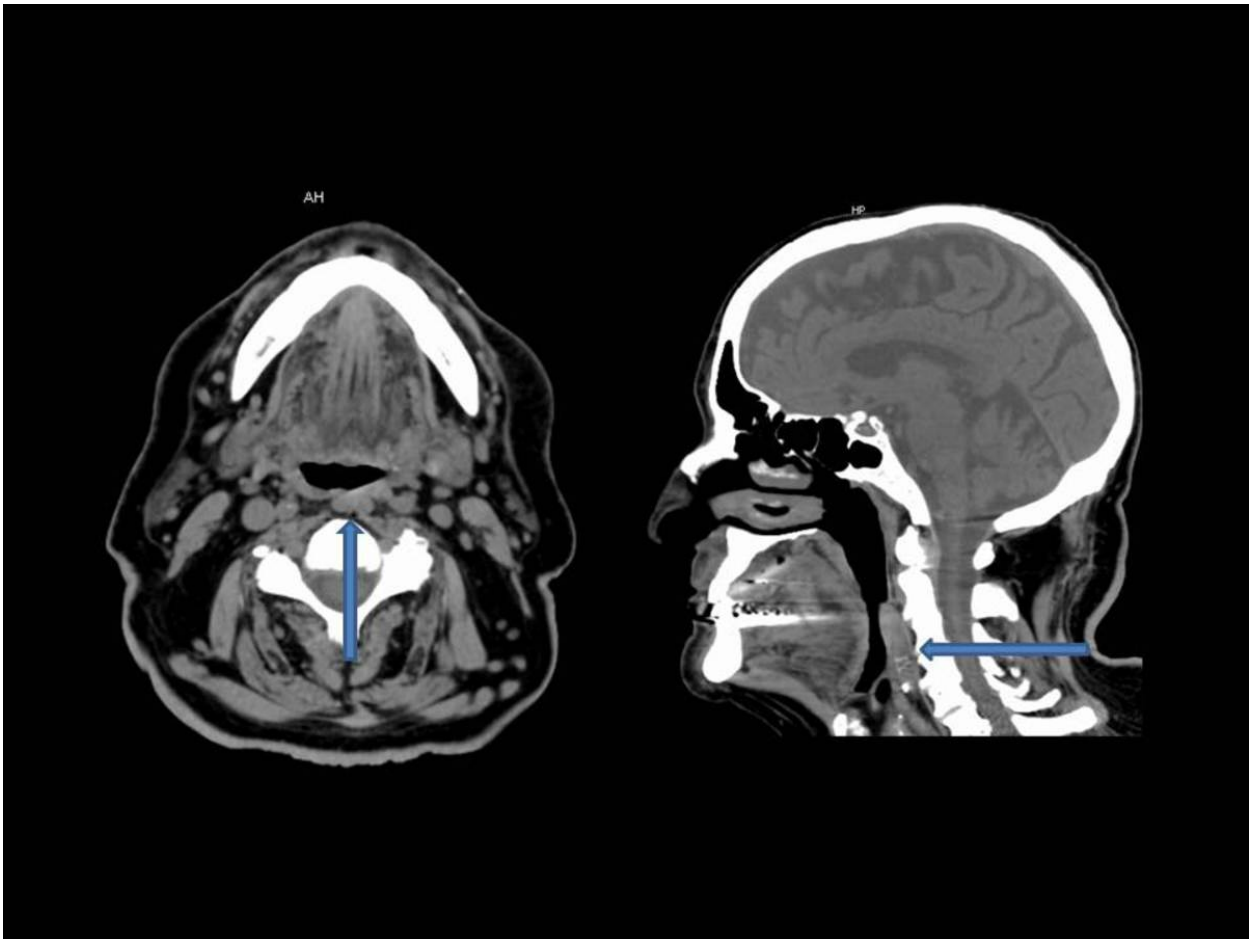

Fig. 8: Tortous internal carotid arteries. Unenhanced computed tomography - axial and sagital views - demonstrates a retropharyngeal mass.

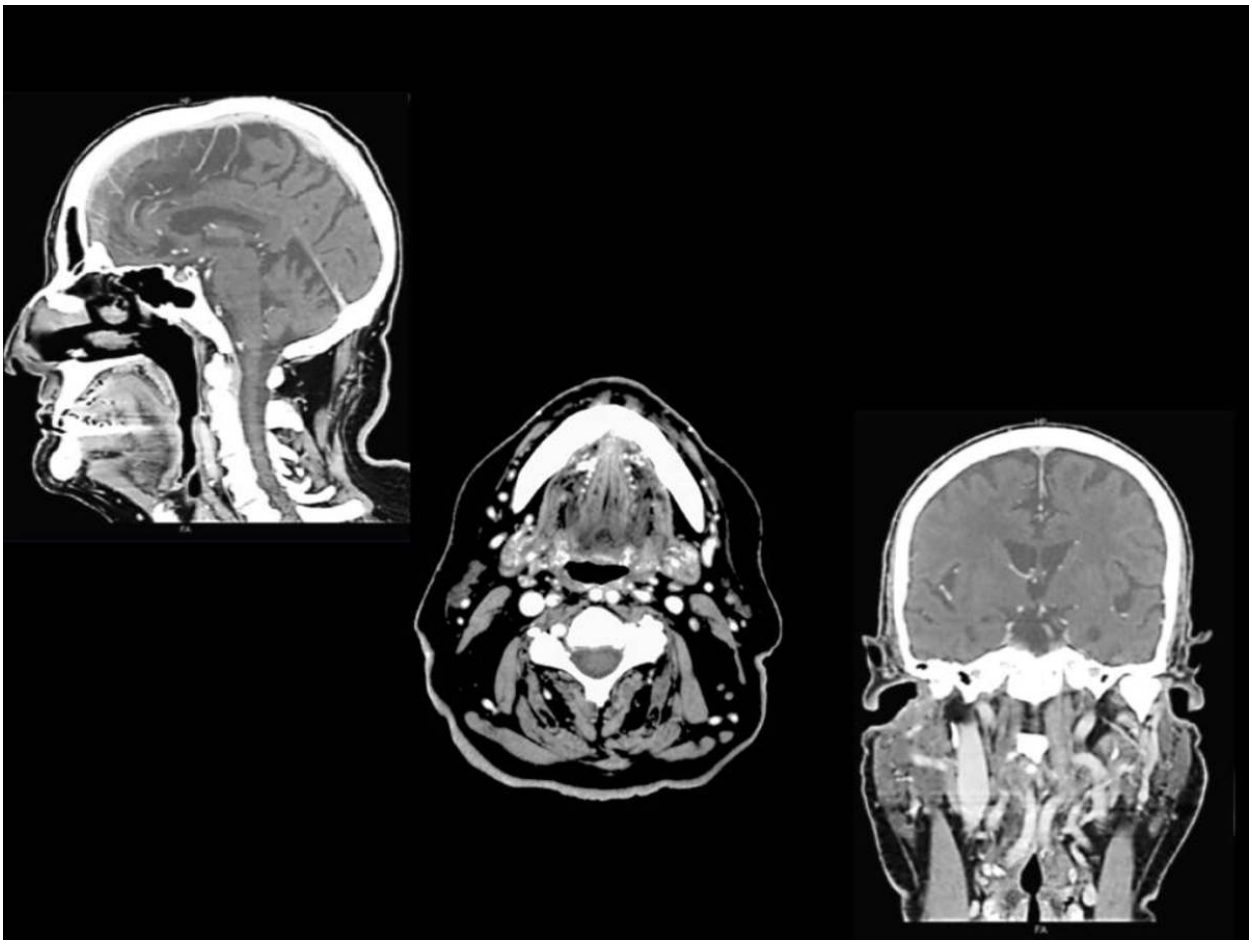

Fig. 9: Tortous internal carotid arteries. Same patient of Fig.8.: enhanced computed tomography - sagital, axial and coronal views - demonstrates medial deviation of both internal carotid arteries into the retropharingeal space.

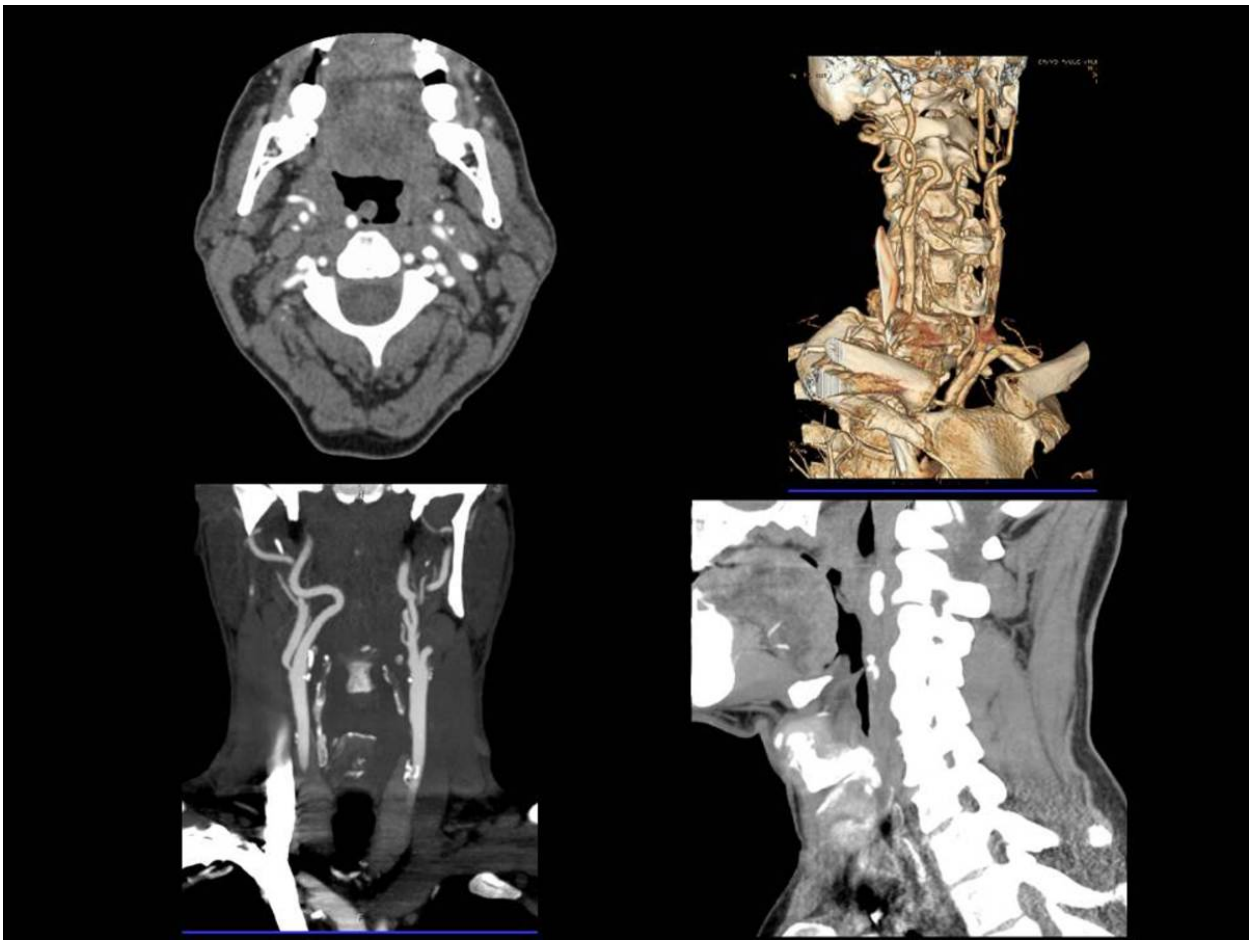

Fig. 10: Tortous internal right carotid artery. Enhanced Computed Tomography - Sagital, Axial, Coronal and Volume Render views - demonstrates tortuosity and medial deviation of right carotid artery into the retropharyngeal space.

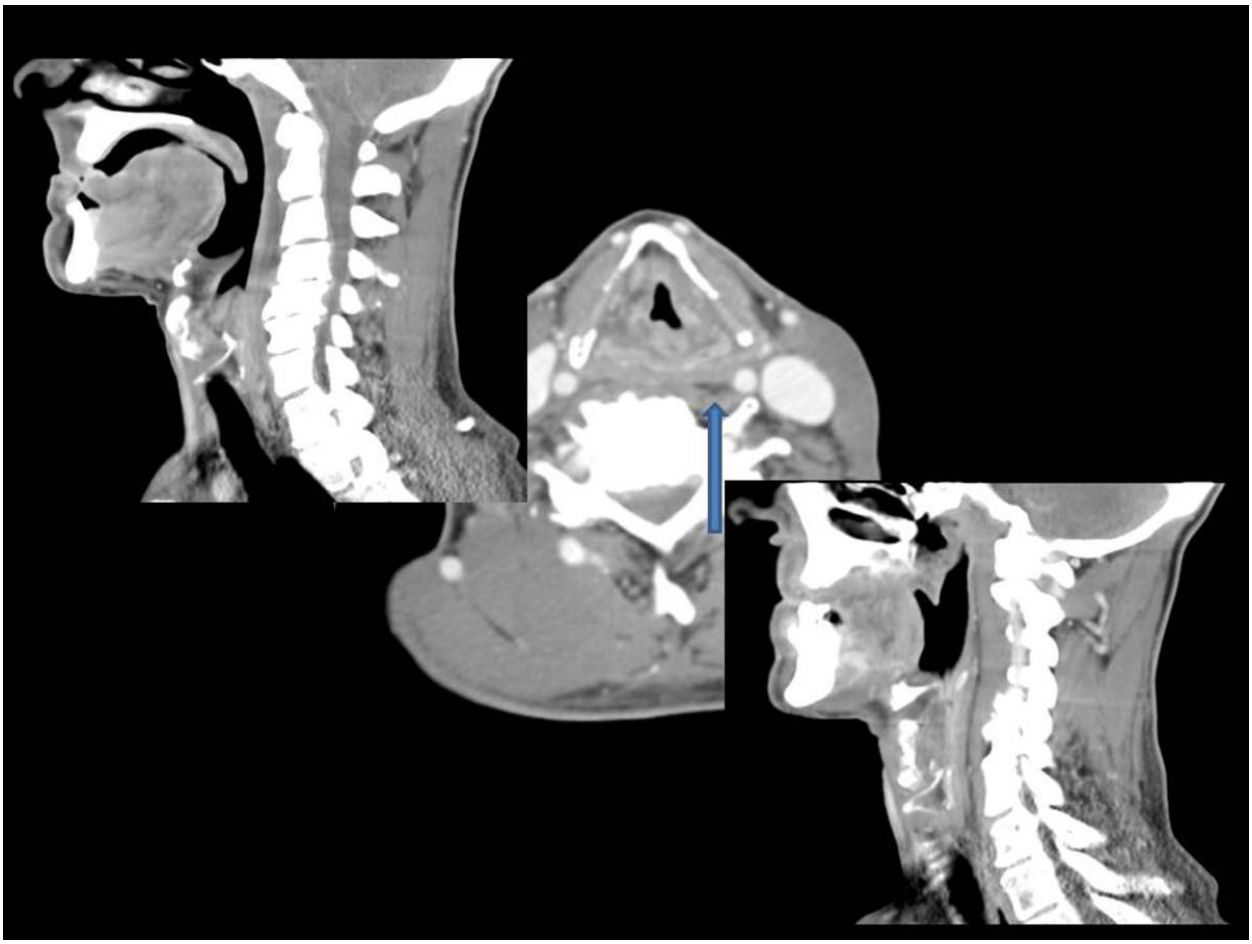

Fig. 11: Retropharyngeal edema: axial and sagital enhanced computed tomography images of a 56 year-old man who had been submitted to neck radiation therapy three months ago to treat a glottic carcinoma. Note the retropharyngeal space swelling and a small amount of fluid in its left half (blue arrow). The fluid collection has a fusiform configuration and tapered margins, with no mass effect and no enhancement. Acknowledgment to the Department of Neuroradiology of the Centro Hospitalar do Porto.

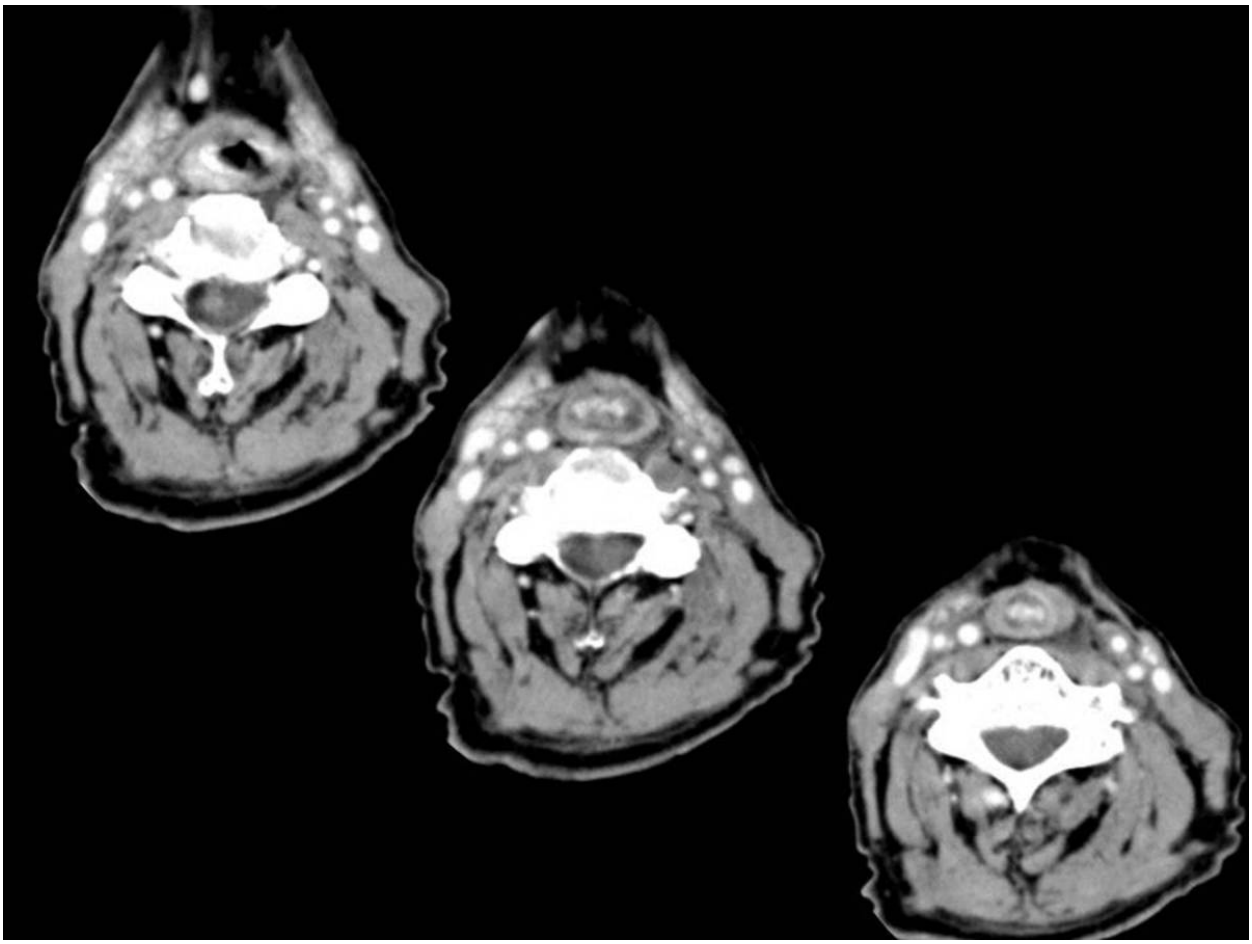

Fig. 12: Retropharyngeal edema: axial enhanced computed tomography images of a 60 year-old man submitted to total laryngectomy and neck radiation therapy. Moderate diffuse swelling and enhancement of the pharyngeal wall associated with mild swelling and small amount of fluid in the retropharyngeal space. Note that there are postradiation imaging findings also in the carotid sheath and the internal jugular veins are thinner.

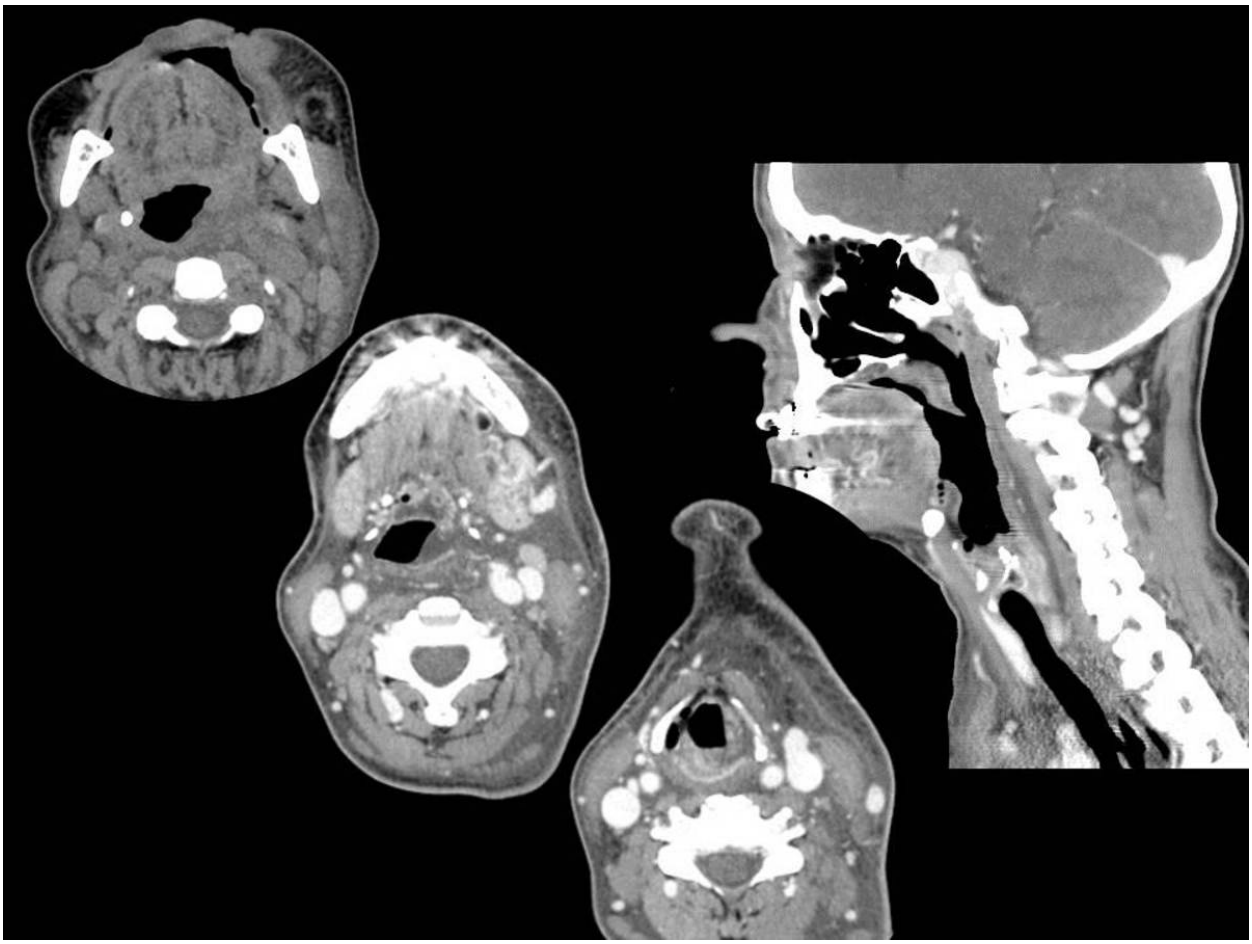

Fig. 13: Retrovisceral edema: axial unenhanced and axial and sagittal enhanced computed tomography images of a 63 year-old woman with left paroditis and cheek cellulitis. Fluid fills the retropharyngeal space from side to side (although of greater volume on the left), has an ovoid configuration and tapered inferior and superior margins, with mild mass effect. It does not enhance.

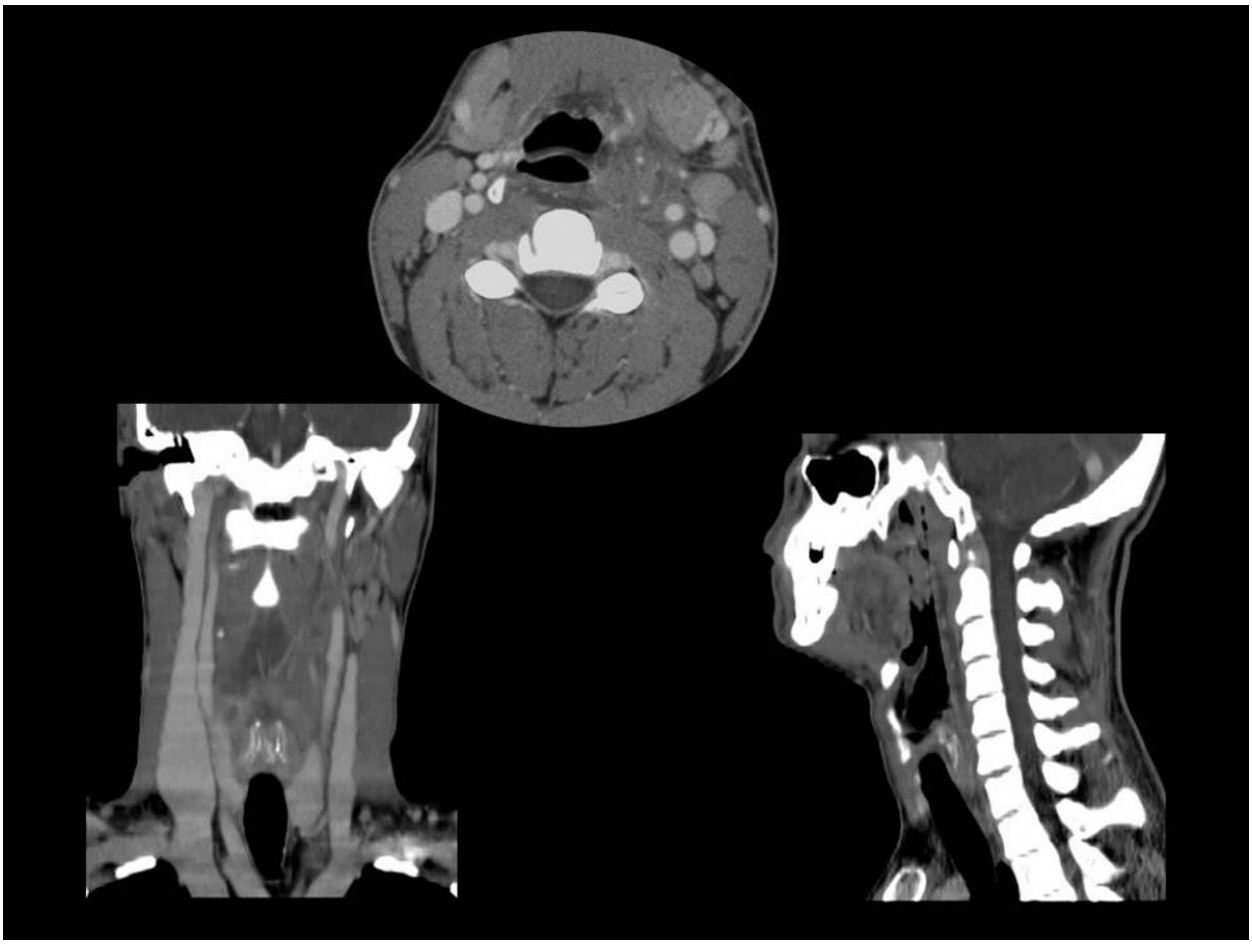

Fig. 14: Retrovisceral edema: axial, coronal and sagital enhanced computed tomography images of a 30 years old man with pharyngitis and an parapharyngeal abscess. Fluid fills the retropharyngeal space from side to side, has a rectangular configuration and tapered inferior and superior margins, with no mass effect or wall enhancement.

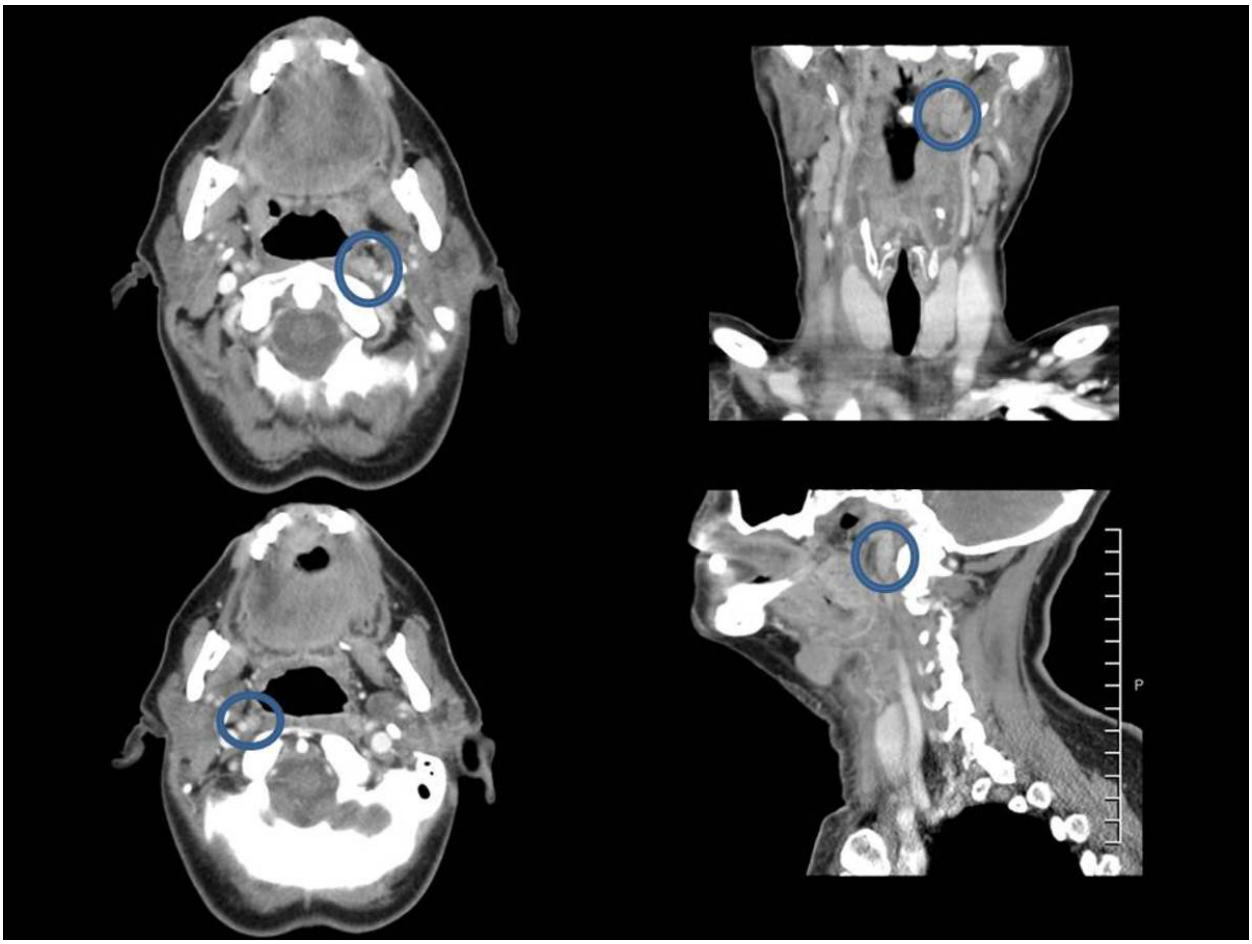

Fig. 15: Reactive retrovisceral nodes. Axial, coronal and sagittal enhanced computed tomography images, at the level of nasopharynx, depicting reactive Rouvière nodes (blue circles) in a 49 year-old woman who has a pretracheal abcess, extending to the retropharyngeal space (see Fig. 16). The nodes are enlarged and enhancing, but don't present hypodense centers. Acknowledgment to the Department of Neuroradiology of the Centro Hospitalar do Porto.

Fig. 16: Retropharyngeal suppurative node and retropharyngeal edema. Axial and sagital enhanced computed tomography images, at the level of naso to oropharynx, of a 63 years old woman with left parotiditis and cheek cellulitis. Blue circles depict a very small collection, with thin high-density rim and mild mass effect - this is consistent with a suppurative lymph node.It is important to notice that in a different patient the same imaging appearance could represent a retropharyngeal metastatic node. The images also show associated retropharyngeal edema, as previously described (Fig. 13).

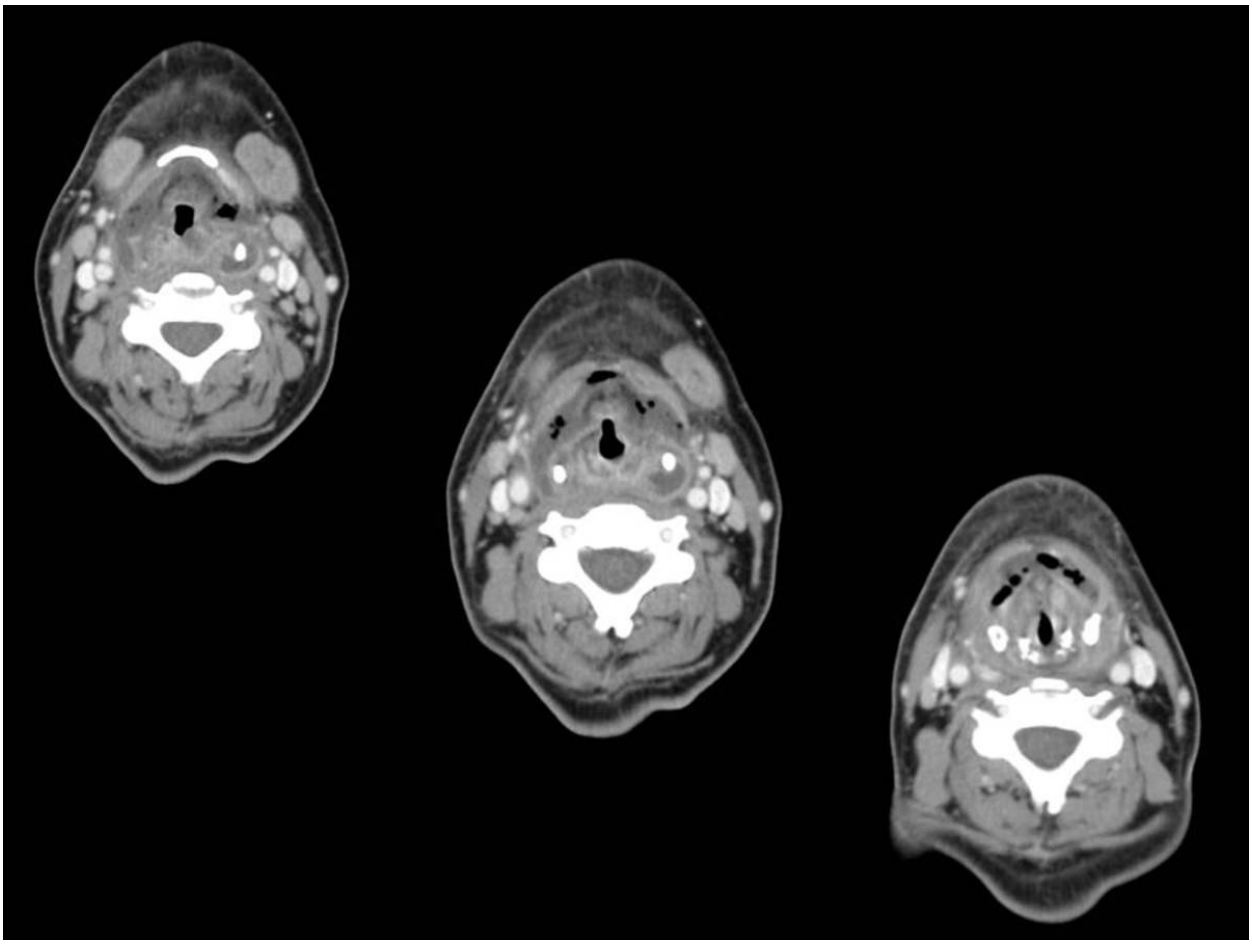

Fig. 17: Pretracheal and retrovisceral abscess. Axial enhanced computed tomography images, at the level of hypopharynx in a 49 year-old woman who has a pretracheal abcess, extending to the retrovisceral space, where we can find an oval collection with thick enhancing wall, producing some mass effect on the left pharyngeal wall. Retrovisceral edema is also present at midline. Acknowledgment to the Department of Neuroradiology of the Centro Hospitalar do Porto.

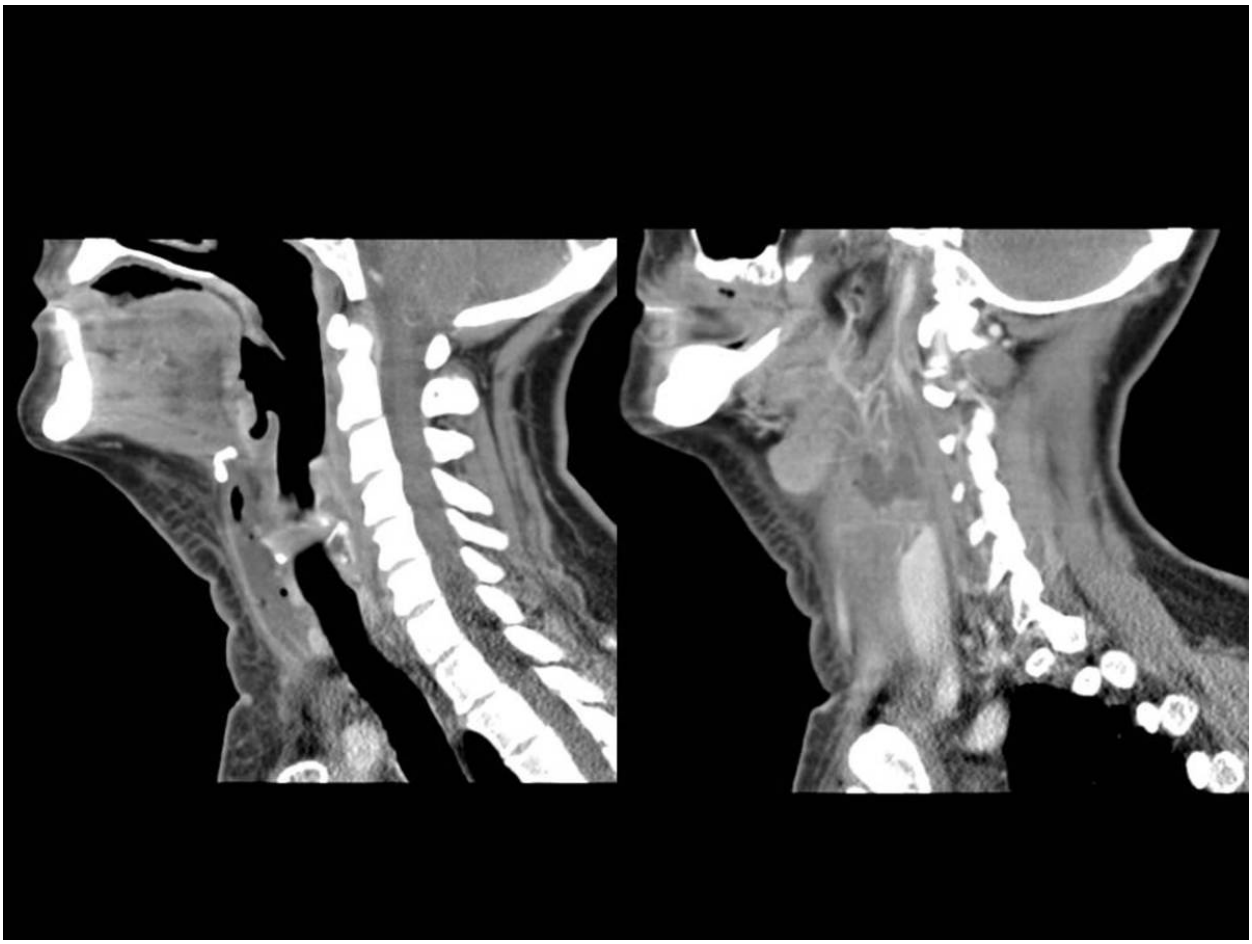

Fig. 18: Pretracheal and retrovisceral abscess. Sagittal enhanced computed tomography images of the same patient from Fig.16, where one appreciate a collection with enhancing wall around the sides of pharynx, spreading to the retrovisceral space through the "gap" between the levels of the oblique line of thyroid cartilage and the inferior thyroid artery (right image. The left image shows a fluid and gas collection on the pretracheal space. Acknowledgment to the Department of Neuroradiology of the Centro Hospitalar do Porto.

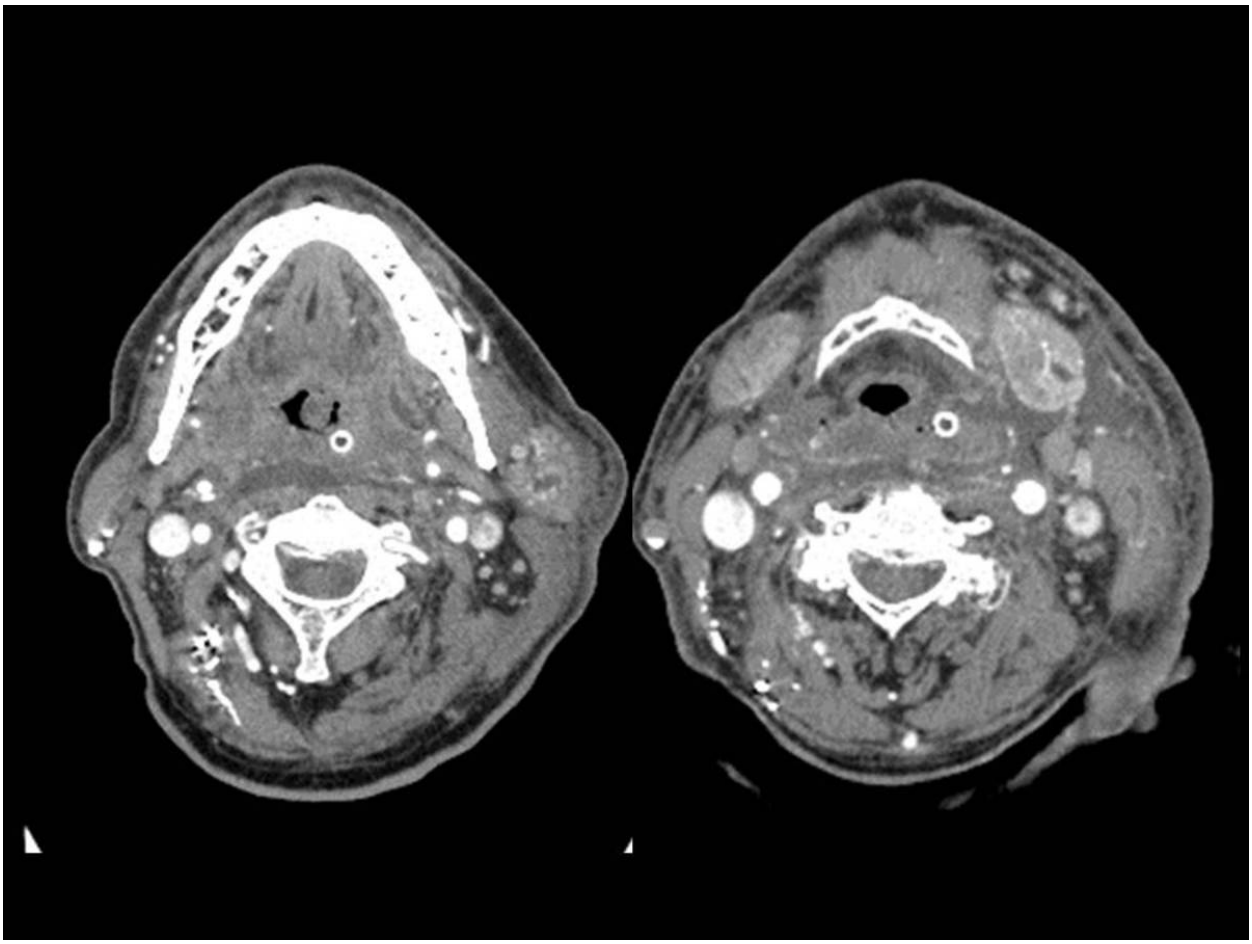

Fig. 19: Retrovisceral and danger space abscess. Axial enhanced computed tomography images of an 73 year-old man with a complicated left parotiditis. Posterior to the pharynx we can see a collection that fills the retrovisceral/danger space from side to side and has a thick enhancing wall. There is also thickening of the pharyngeal wall. In the left image we can observe swelling of the left parotid, with abnormal parenchymal enhancing and a small collection inside it. The right image shows that the infection occupies also the leftsubmandibular and parapharyngeal spaces.

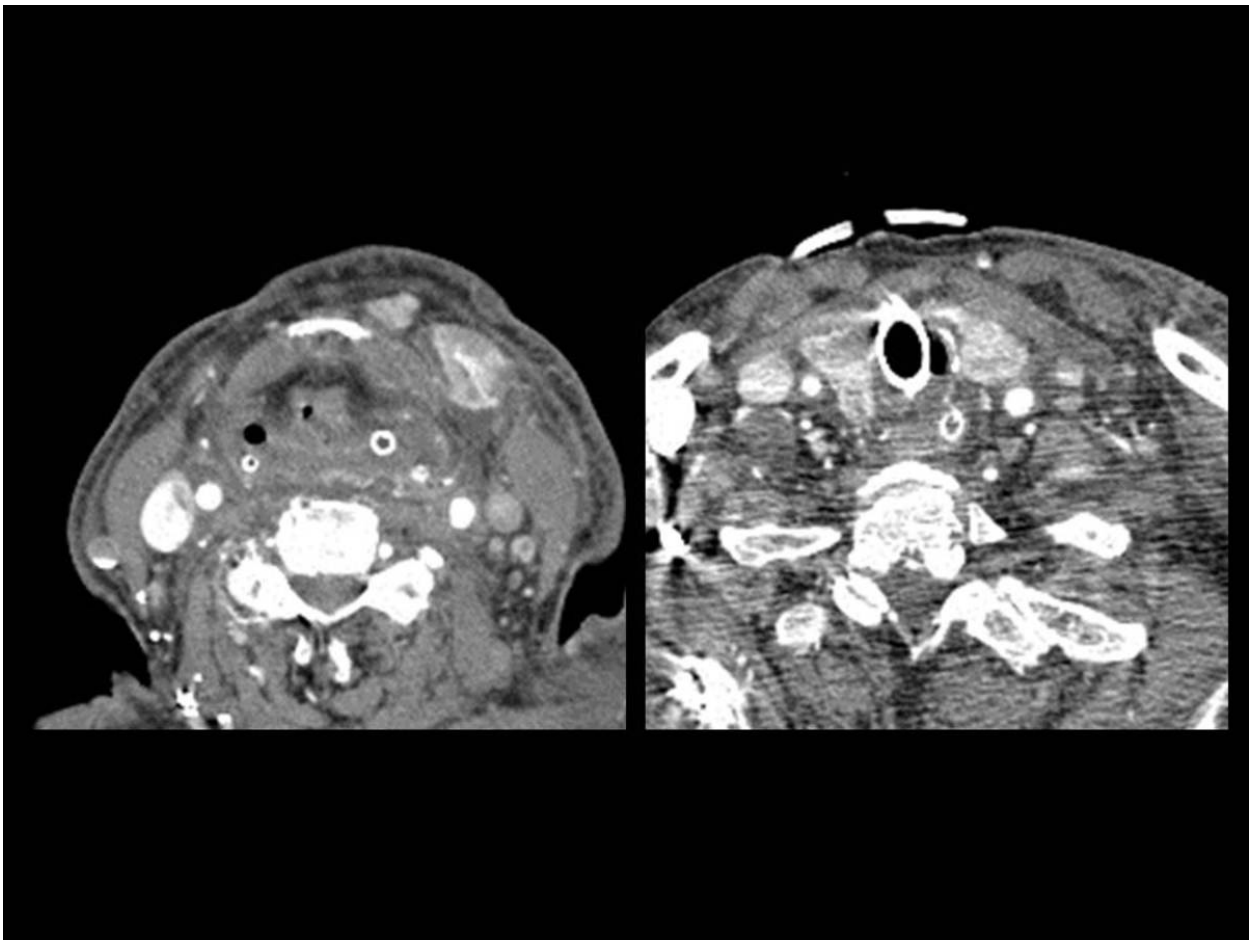

Fig. 20: Retrovisceral and danger space abscess. Same patient from Fig.19. Axial enhanced computed tomography images at the level of the hypopharynx. The phayngeal wall thickning and the retrovisceral/danger space collection produced mass effect on the airway, so patient needed intubation. There is also flattening of the prevertebral muscles.

Fig. 21: Retrovisceral and danger space abscess. Same patient from Fig.19. Sagittal and coronal enhanced computed tomography images. Note the phayngeal wall swelling and the retrovisceral/danger space collection (extending caudally) mass effect on the airway, obliterating it.

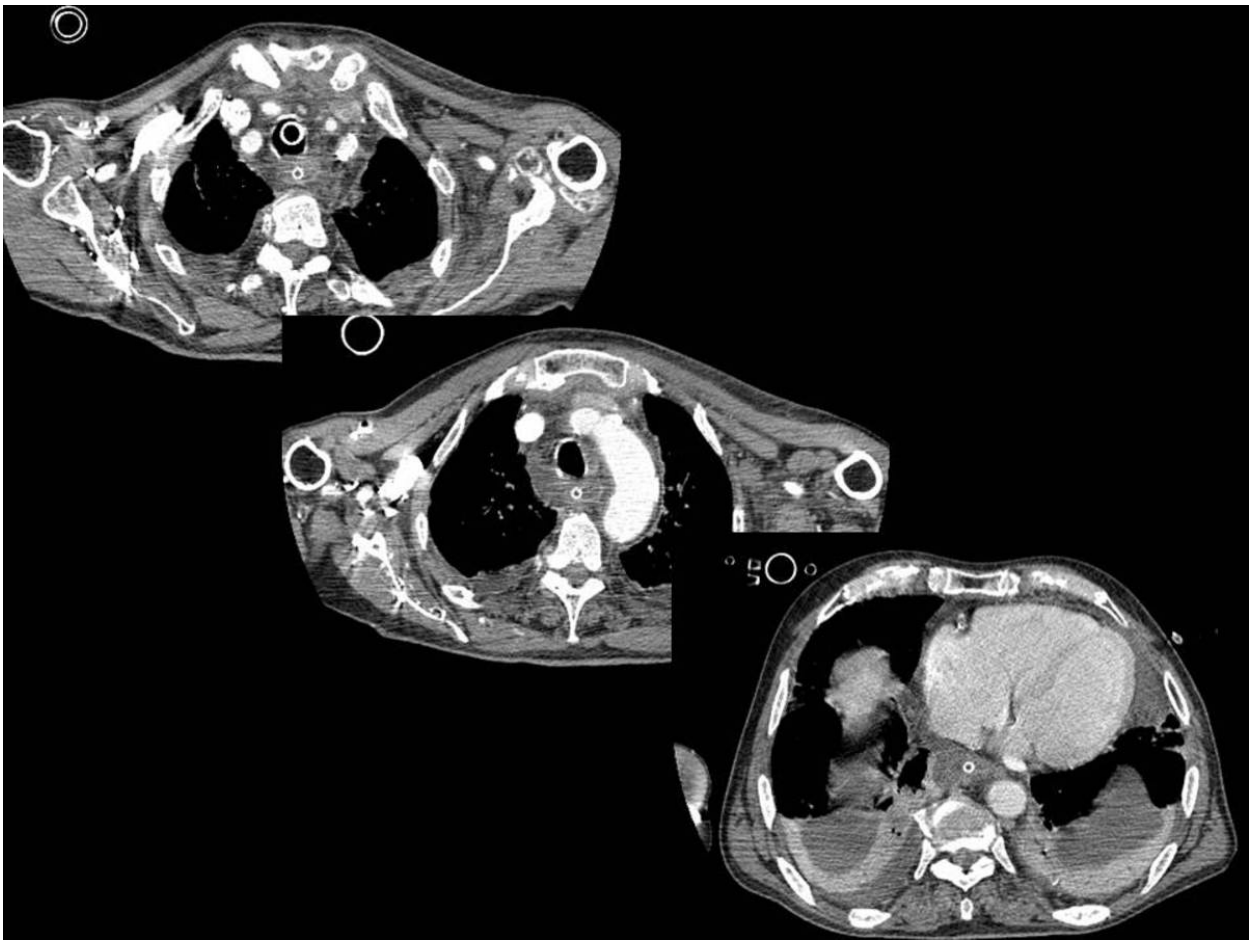

Fig. 22: Retrovisceral/danger space abscess complicated with descending mediastinitis. Same patient from Fig.19. Thoracic axial enhanced computed tomography images. Despite the fact that all the mediastinal fat has an increased attenuation, it is obviously in the posterior mediastinum, surrounding the esophagus, that a collection is evident. There are also signs of bilateral empyema - collected pleural effusion (inferior image) and enhancing pleural thickening (best depicted in the middle image) - and bilateral lung parenchymal consolidation.

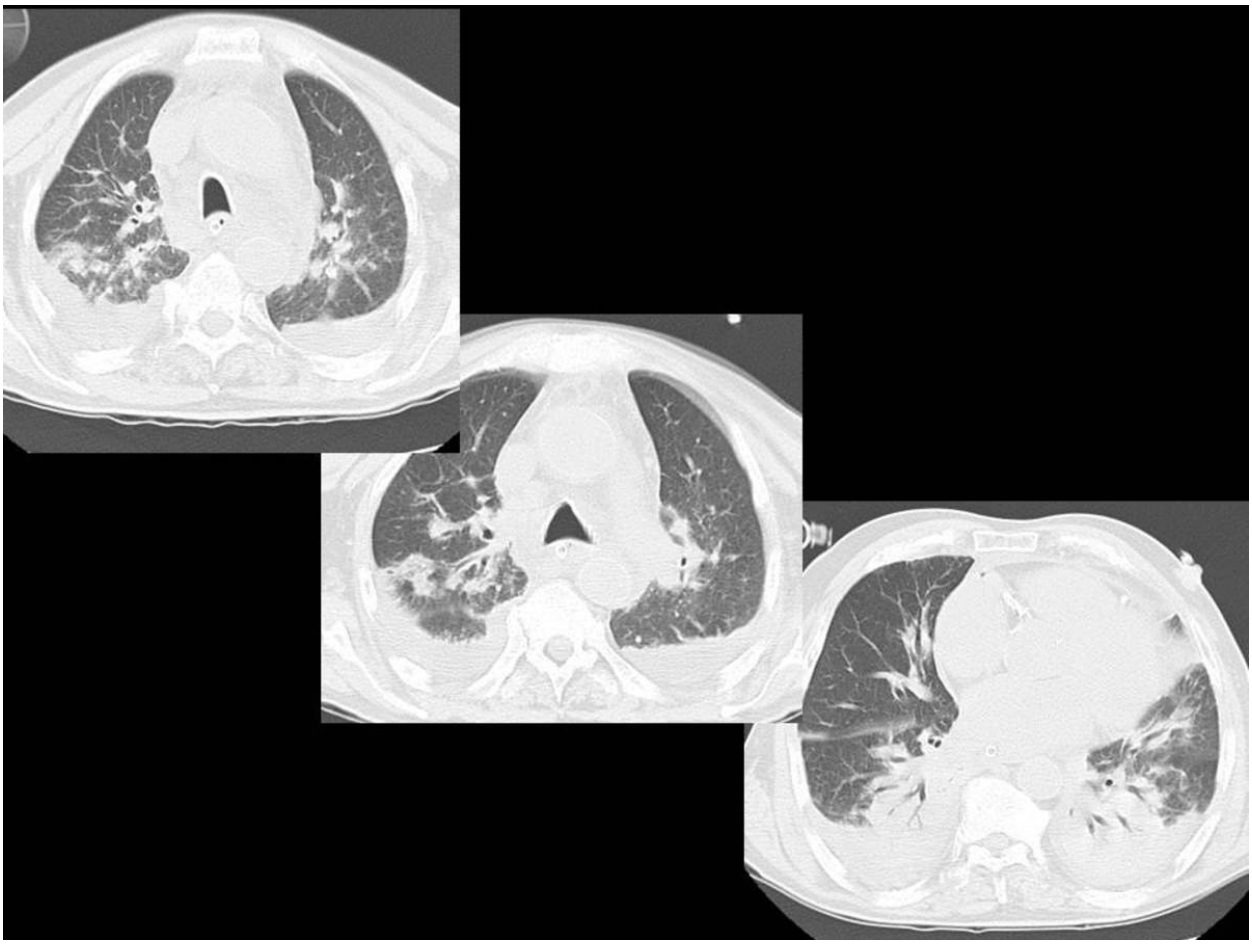

Fig. 23: Retrovisceral/danger space abscess complicated with descending mediastinitis, empyema and pneumonia. Same patient from Fig.19. Thoracic axial enhanced computed tomography images, lung window. Bilateral lower lobe pneumonic consolidation with air bronchogram associated with partial passive colapse related to the empyema. Bronchial wall thicking and peribronchial consolidation in all lobes is apparent, as well as small nodules in the superior lobes at the bronchial extremities - bronchopneumonia.

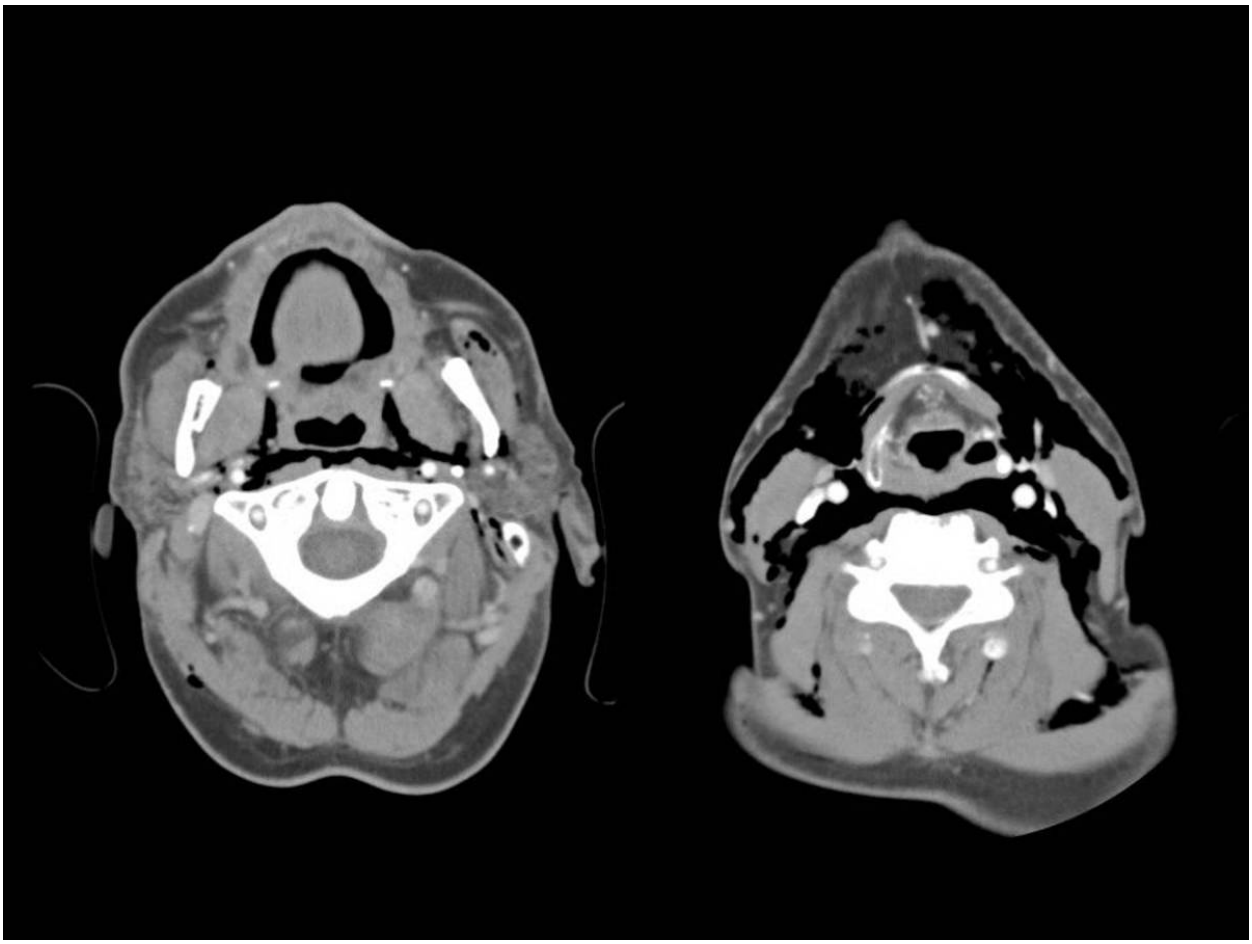

Fig. 24: Retrovisceral and danger space emphysema. Axial computed tomography images of a 70 year-old man who developed extensive neck emphysema after tracheostomy and assisted ventilation. Air is present in all neck spaces. Note that it delineates the fascial planes between the retropharyngeal/danger spaces and the parapharyngeal space (left image) and between the retropharyngeal and the pretracheal spaces (right).

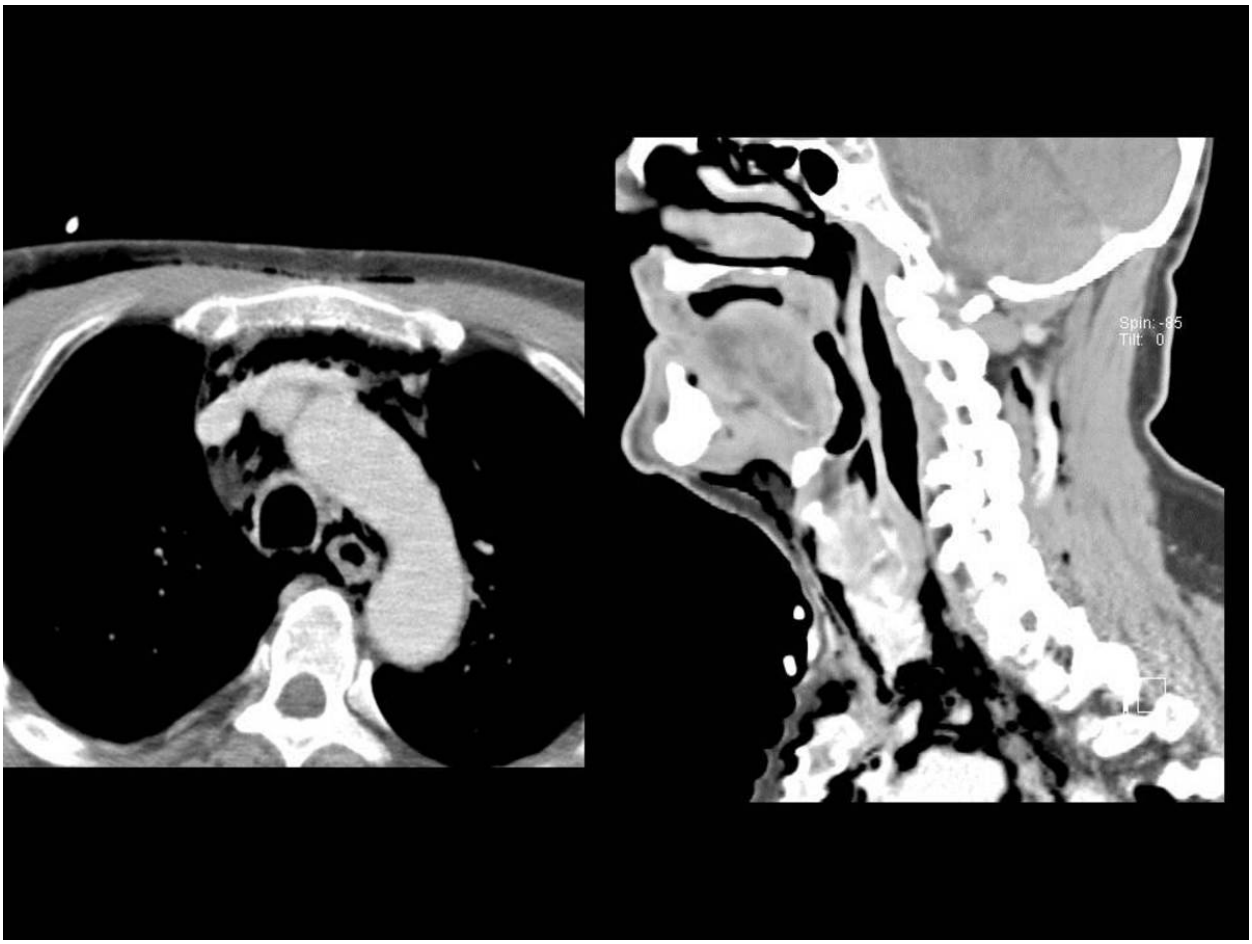

Fig. 25: Retrovisceral/danger space emphysema and pneumomediastinum. Contrast-enhanced computed tomography, sagittal neck and axial thoracic images of the same patient of Fig. 24. Pneumomediastinum (left image). Air present in the retrovisceral space produces mass effect on the pharyngeal lumen (right image).

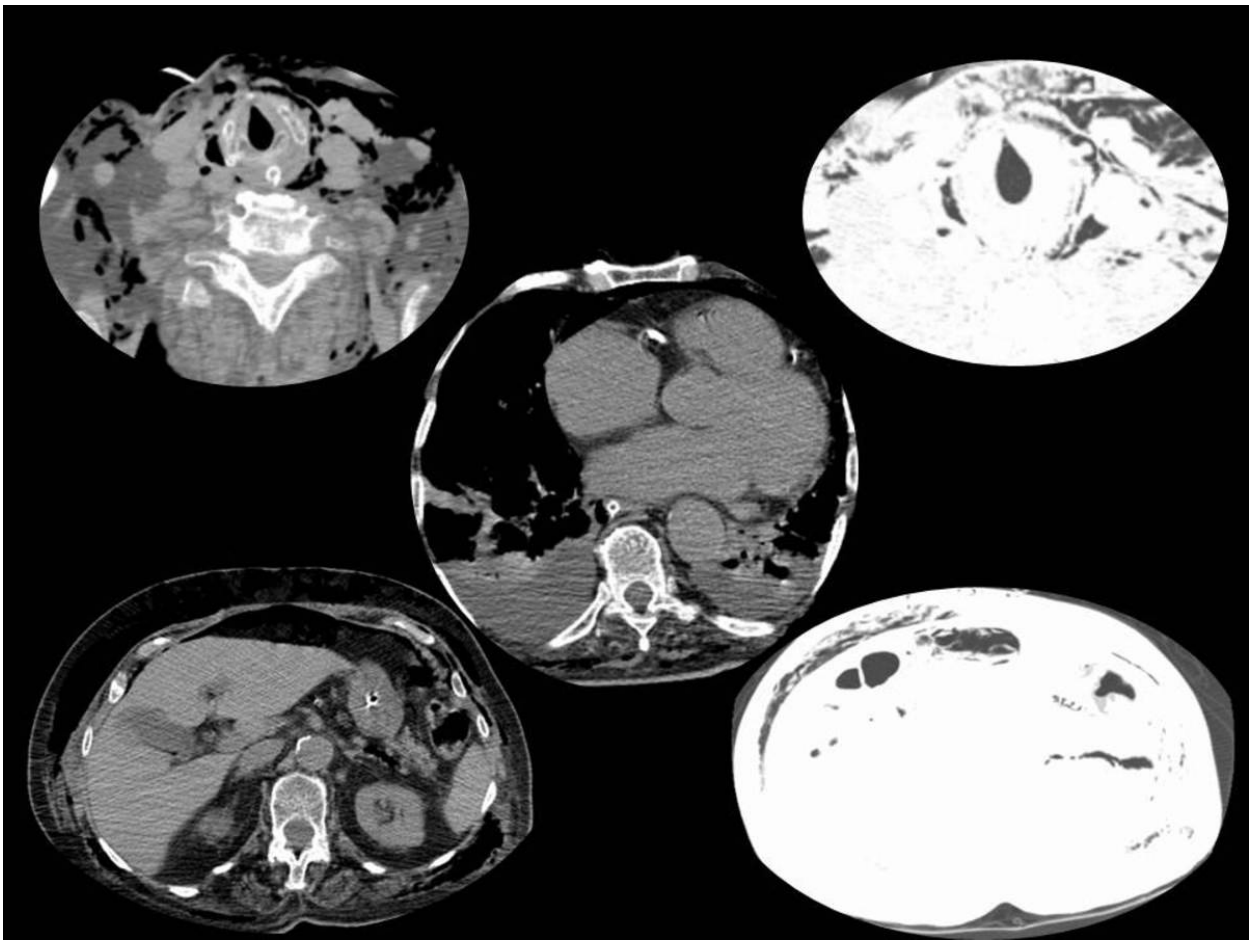

Fig. 26: Retrovisceral/danger space emphysema, pneumomediastinum and retroperitoneum. Neck, thoracic and abdominal axial unenhanced computed tomography images of a 74 year-old man who developed cutaneous emphysema after nasogastric tube intubation.

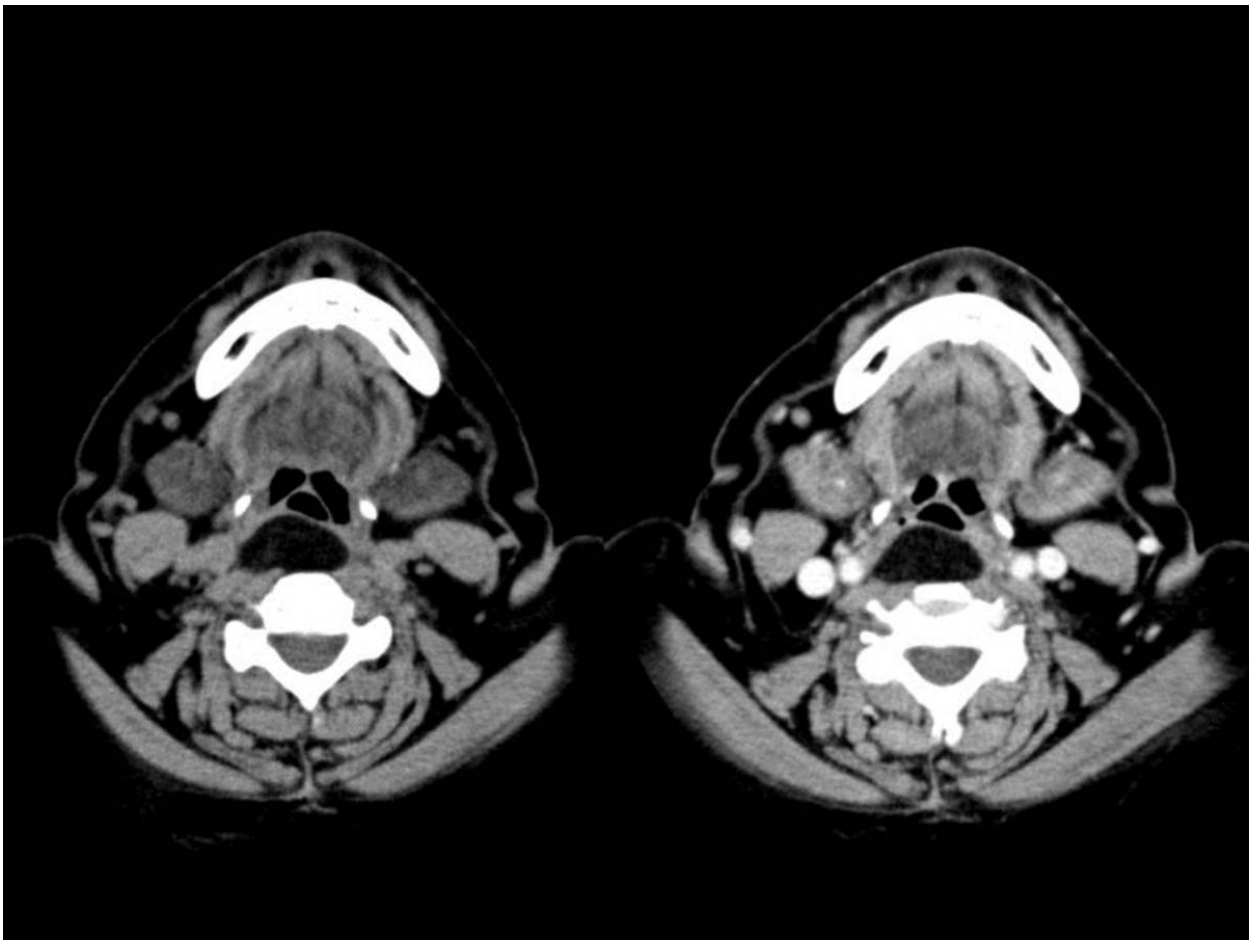

Fig. 27: Retropharyngeal lipoma. Axial computed tomography images of a 63 year- old man presenting with obstructive sleep apnoea, demonstrate a well-defined homogenous fat density mass with thin septa that didn't enhance in the retropharyngeal space. There is no clearly identifiable capsule. The lesion produces mass effect on the airway.

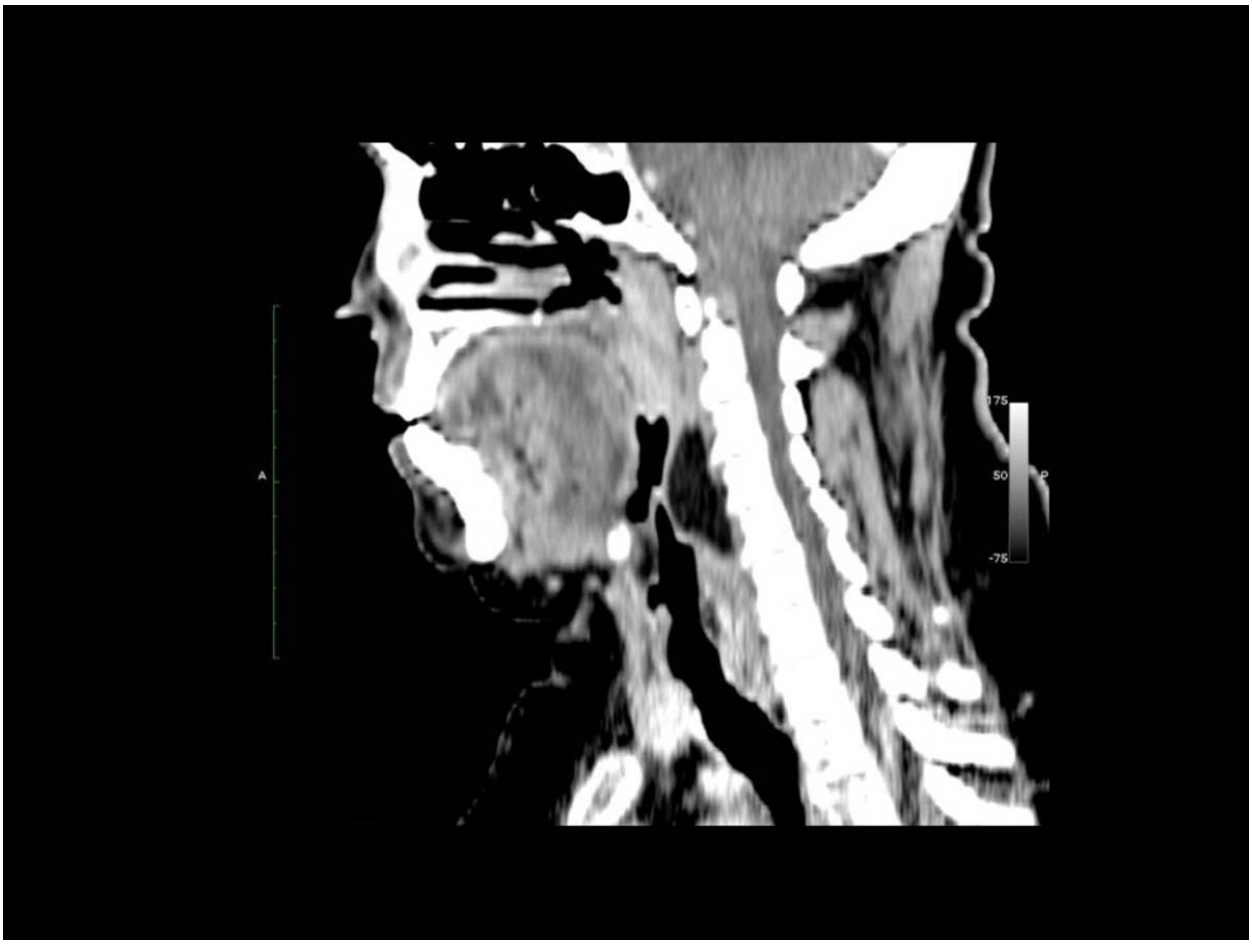

Fig. 28: Retropharyngeal lipoma. Same patient from Fig. 27. The sagital enhanced computed tomography image shows an ovoid homogenous fat mass extending along the retropharyngeal space, producing mass effect on the airway.

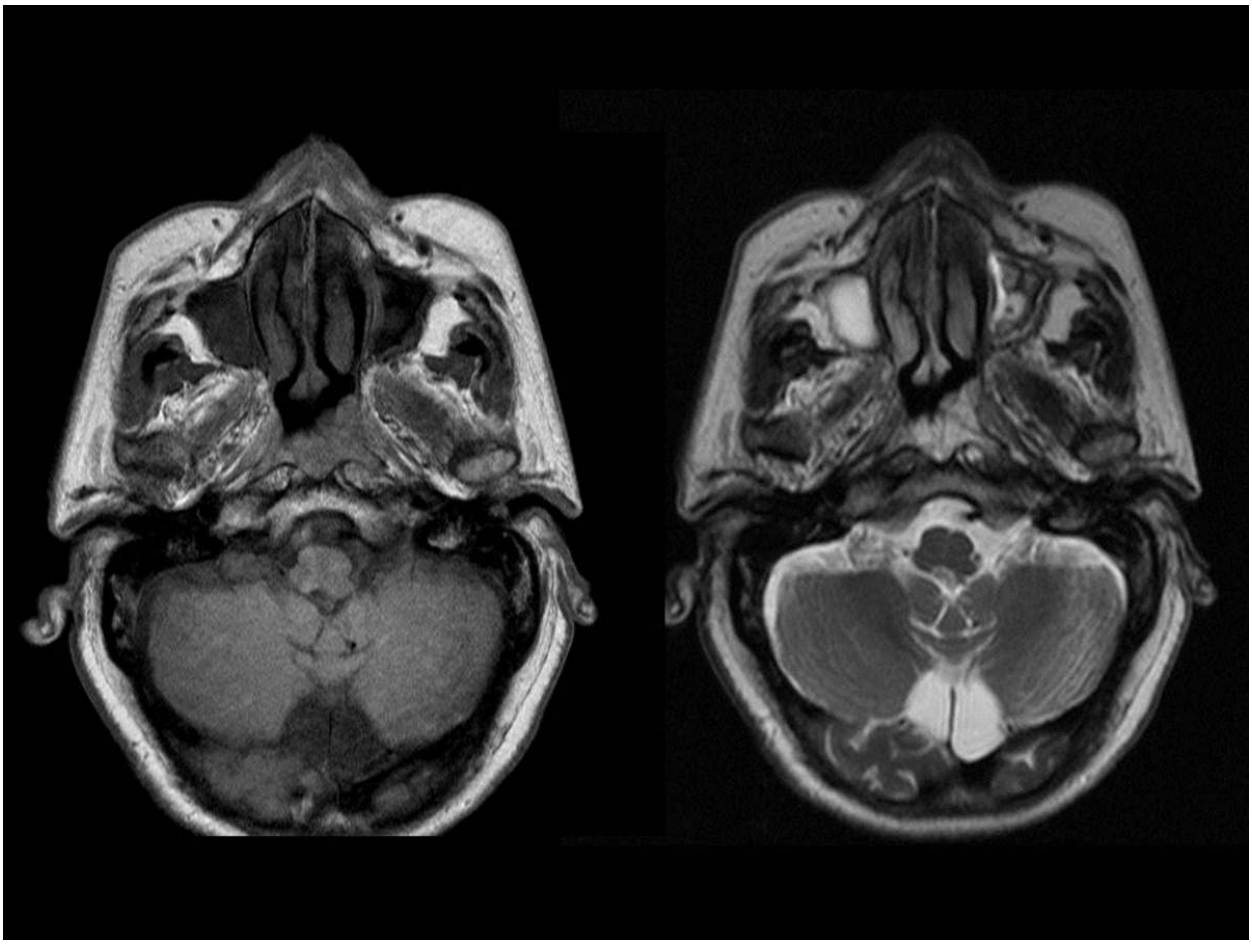

Fig. 29: Nasopharyngeal hemangioma. Male, 74 years old, suspected of having a nasopharyngeal carcinoma. Axial nasopharyngeal FSE MR images show a homogeneous mass, hypointense on T1-weighted (left)and moderately hyperintense on T2-weighted (right) occupying the posterior and left walls of the nasopharynx. The mass blunt the Rosenmüller fossa and appeared to invade the longus capitis and longus colli muscles.

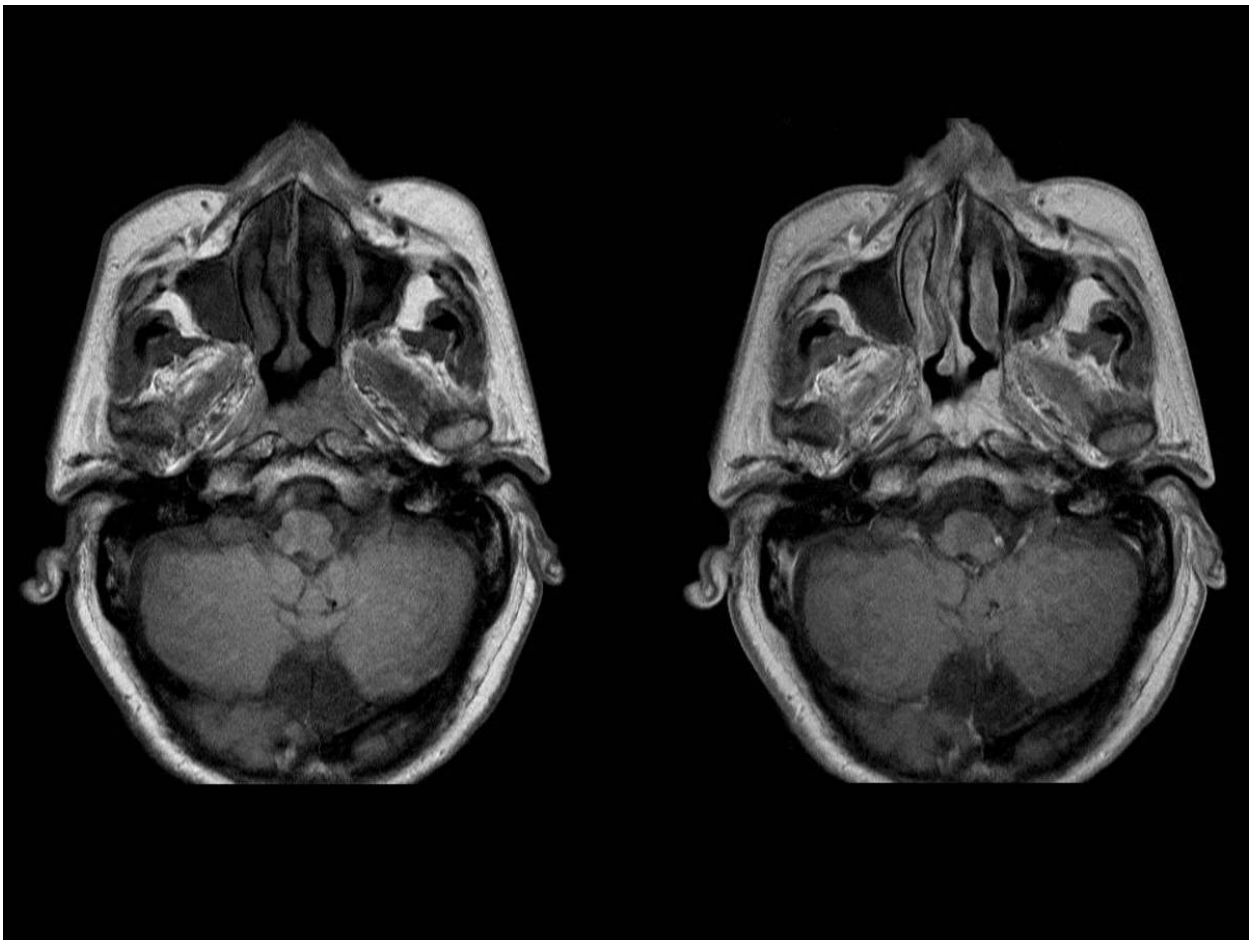

Fig. 30: Nasopharyngeal hemangioma. Same patient from Fig.29. Axial nasopharyngeal FSE MR images, unenhanced (left image) and enhanced (right image) demonstrate that the mass enhances homogeneously. Biopsy confirmed the diagnosis of a was a cavernous hemangioma whichhas remained stable over time.

Fig. 32: Nodular fasciitis. A 10-year-old female patient presented with sneezing, obstructive sleep apnoea and a right lateral cervical mass, which had enlarged in the past four months. The patient denied pain, dysphonia or dysphagia. Lateral cervical spine X-ray depicts anterior convex bowing of the air column produced by a soft tissue mass. Acknowledgment to the Department of Radiology of the Hospital Pediátrico de Coimbra.

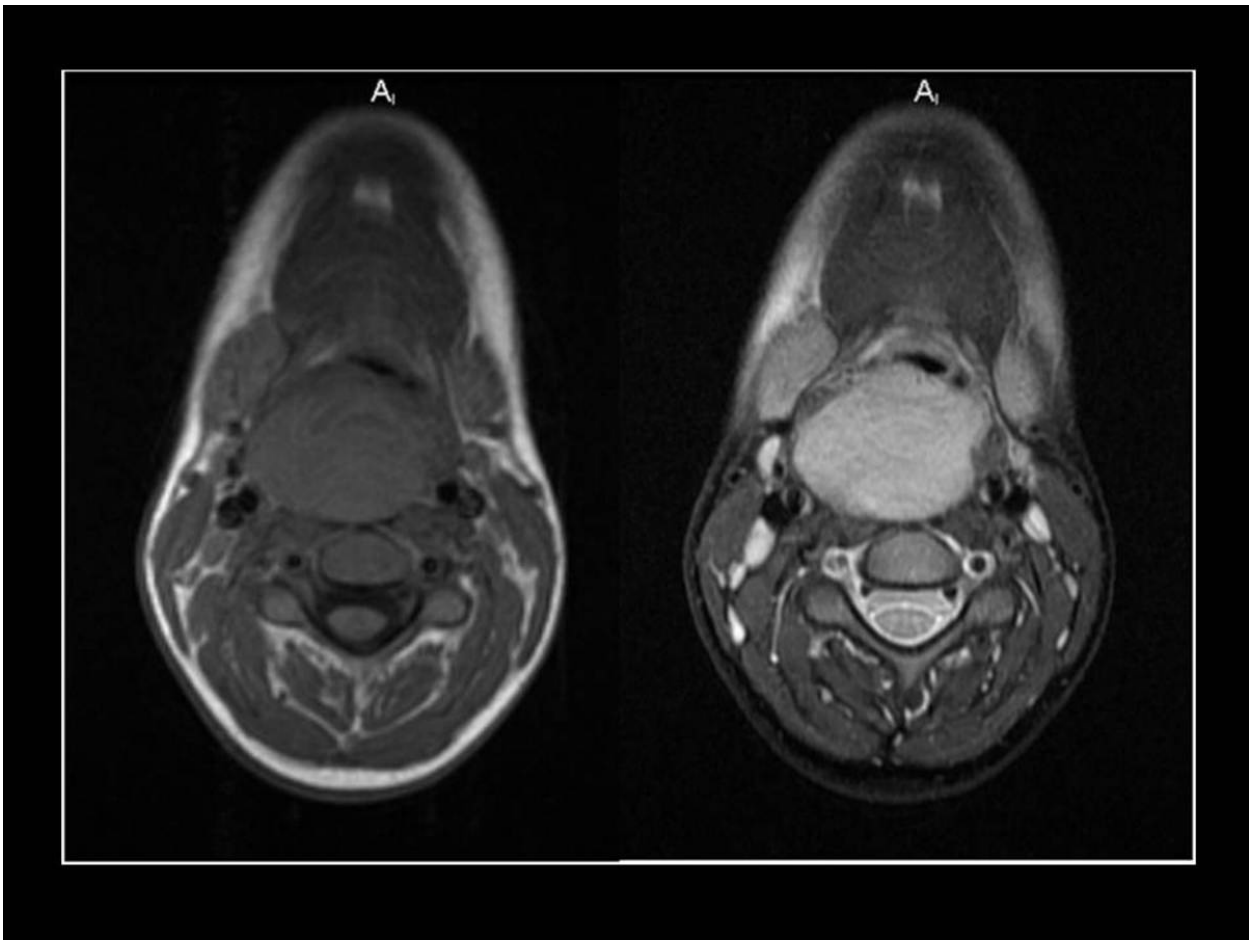

Fig. 33: Nodular fasciitis. Same patient as Fig.32. Axial mid-cervical FSE MR images, T1-weighted (left) and T2-weighted (right). An oval-shaped, solid, homogeneous, with high SI on T2WI and intermediate SI on T1WI mass displaced the pre-vertebral muscles posteriorly and the hypopharynx and larynx anteriorly, suggesting a retropharyngeal origin. No clear signs of invasion of these structures were observed. There were no signs of invasion of the prevertebral muscles or cervical spine either. Acknowledgment to the Department of Radiology of the Hospital Pediátrico de Coimbra.

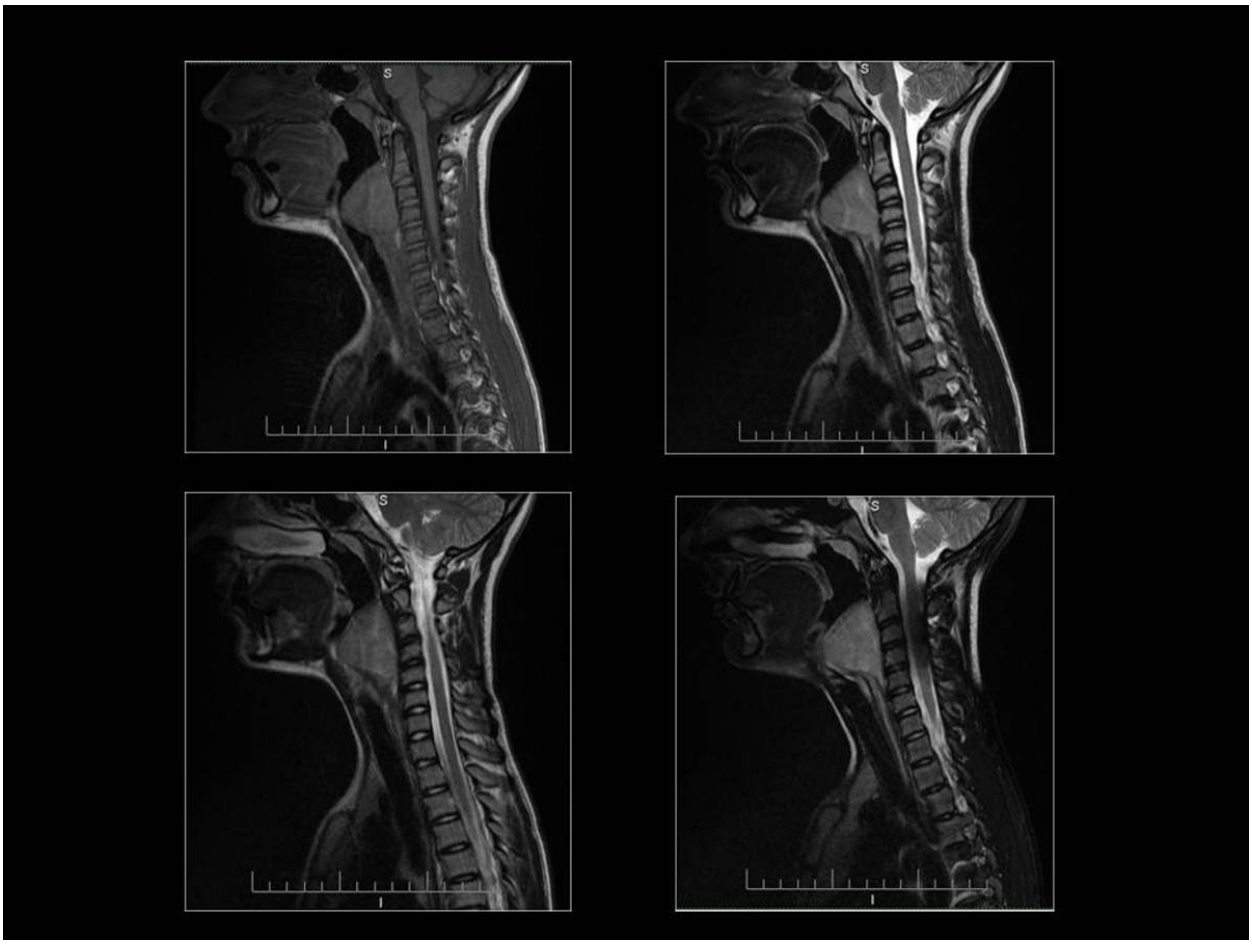

Fig. 34: Nodular fasciitis. Same patient from Fig.32. Sagittal cervical FSE T1WI (left superior image). The oval retropharyngeal mass displayed intermediate SI in T1WI. It presented with regular borders and showed no signs of invasion of the cervical spine. Sagittal cervical FSE T2-weighted MR images. The mass had high signal intensity on T2WI. The posterior pharyngeal mucosa was displaced anteriorly by the mass but showed no clear signs of invasion. Acknowledgment to the Department of Radiology of the Hospital Pediátrico de Coimbra.

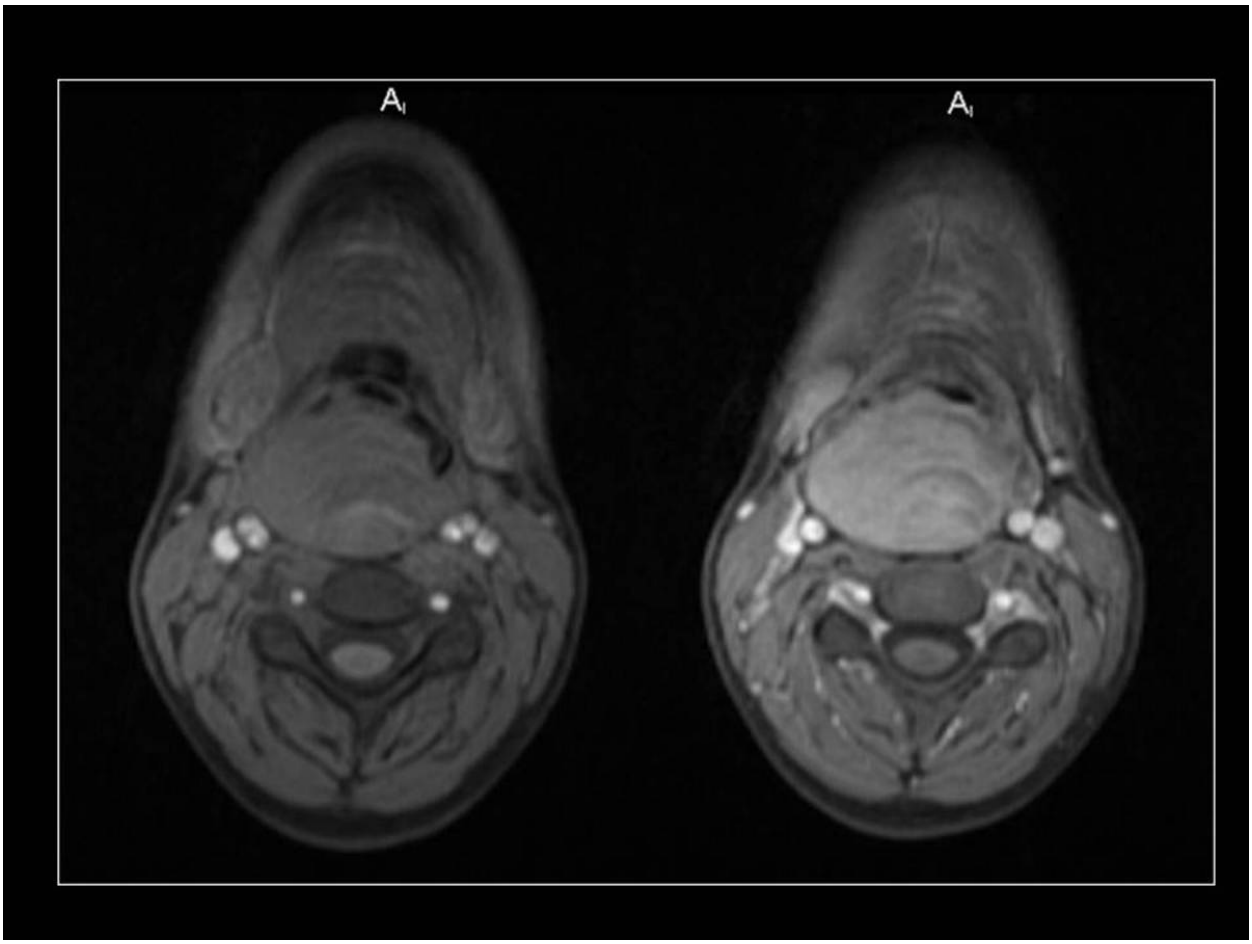

Fig. 35: Nodular fasciitis. Same patient from Fig.32. Axial GRE FS T1-weighted pre (left) and post-contrast (right) MR images. The mass did not show a SI loss on FS images, thus excluding the presence of macroscopic fat, and displayed a heterogeneous enhancement after IV contrast. Acknowledgment to the Department of Radiology of the Hospital Pediátrico de Coimbra.

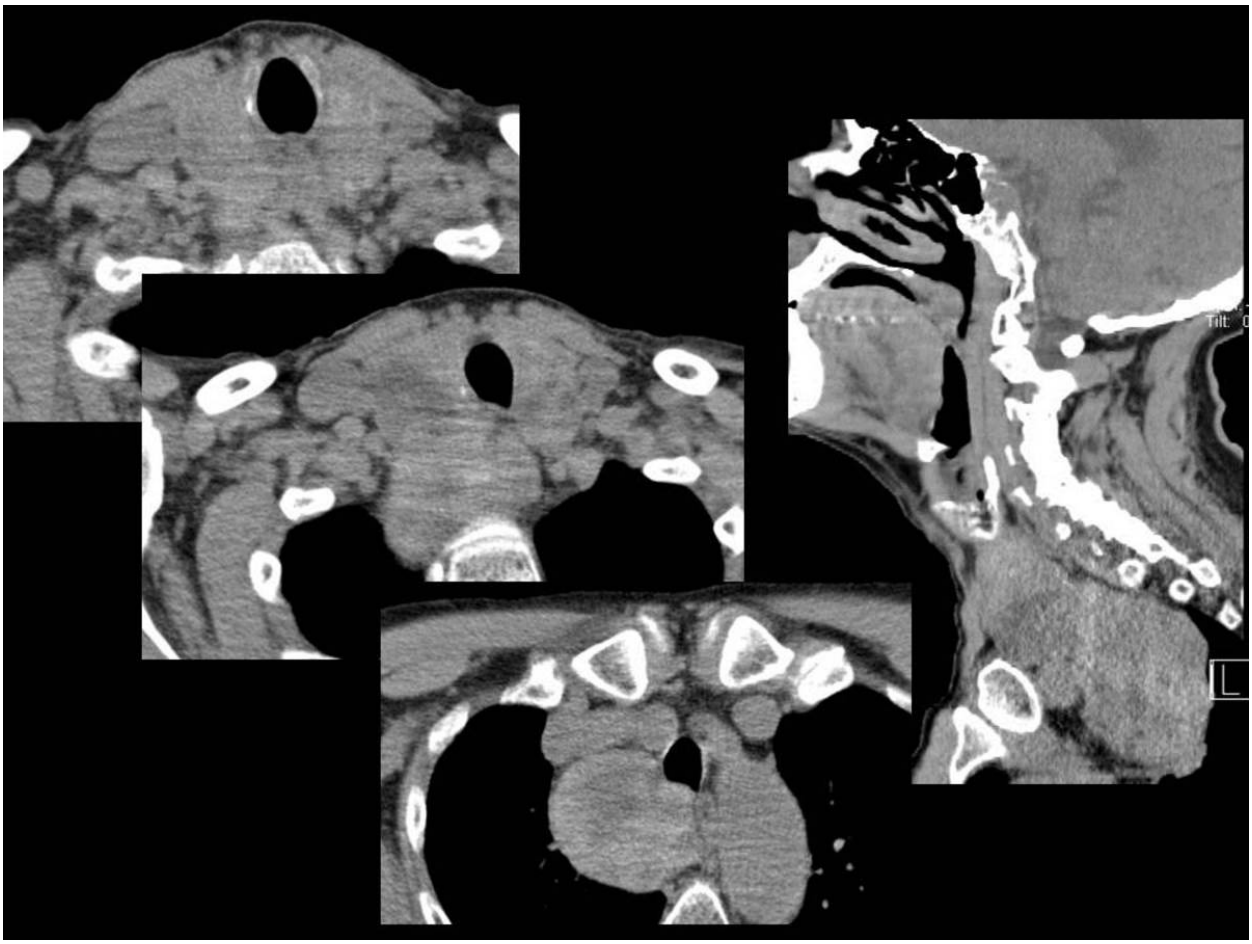

Fig. 36: Goiter. Axial and sagital unenhanced computed tomography images of a 70 year-old woman. A large goiter crosses posteriorly to the retrovisceral space and from there extends downwards in the posterior mediastinum. Note it produces mass effect, displacing anteriorly the larynx, the trachea and the grat vessels.

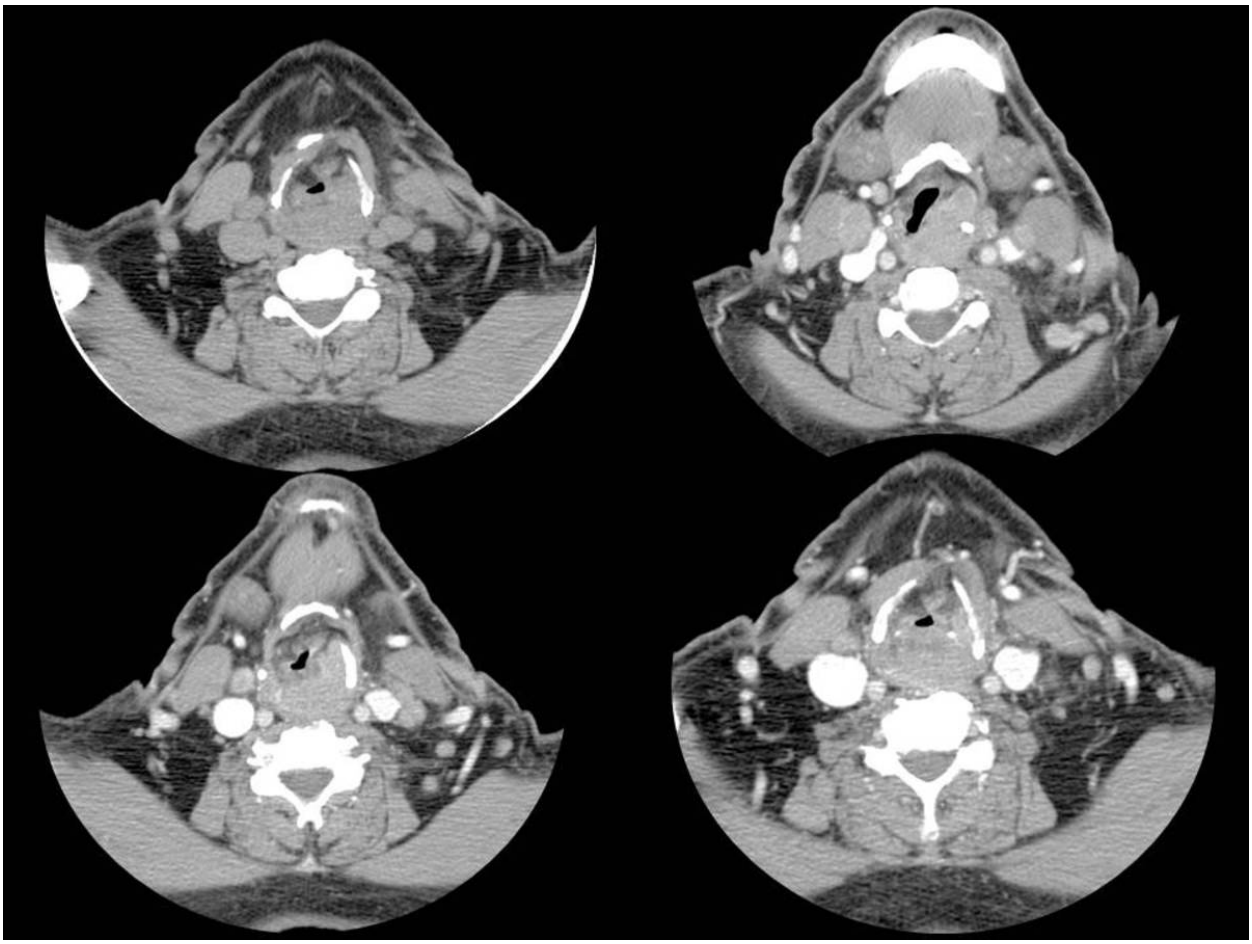

Fig. 37: Squamous cell carcinoma of the pharynx. Axial unenhanced and enhanced computed tomography images at the level of the hypopharynx demonstrate a extensive infiltrative lesion centered in the left pyriform sinus that crosses along the lateral pharyngeal wall and invades the retropharyngeal fat. The lesion also crosses the left pharyngo-epiglottic fold and invades the parapharyngeal space. The danger space probably is also infiltrated, although invasion of the prevertebral muscles is not clearly depicted. This lesion produces mass effect on the airway and shows moderate contrat enhancement. There are several adenopathies: at the left a cluster invades the internal jugular vein; at the right the vein is only slightly compressed. Acknowledgment to the Department of Neuroradiology of the Centro Hospitalar do Porto.

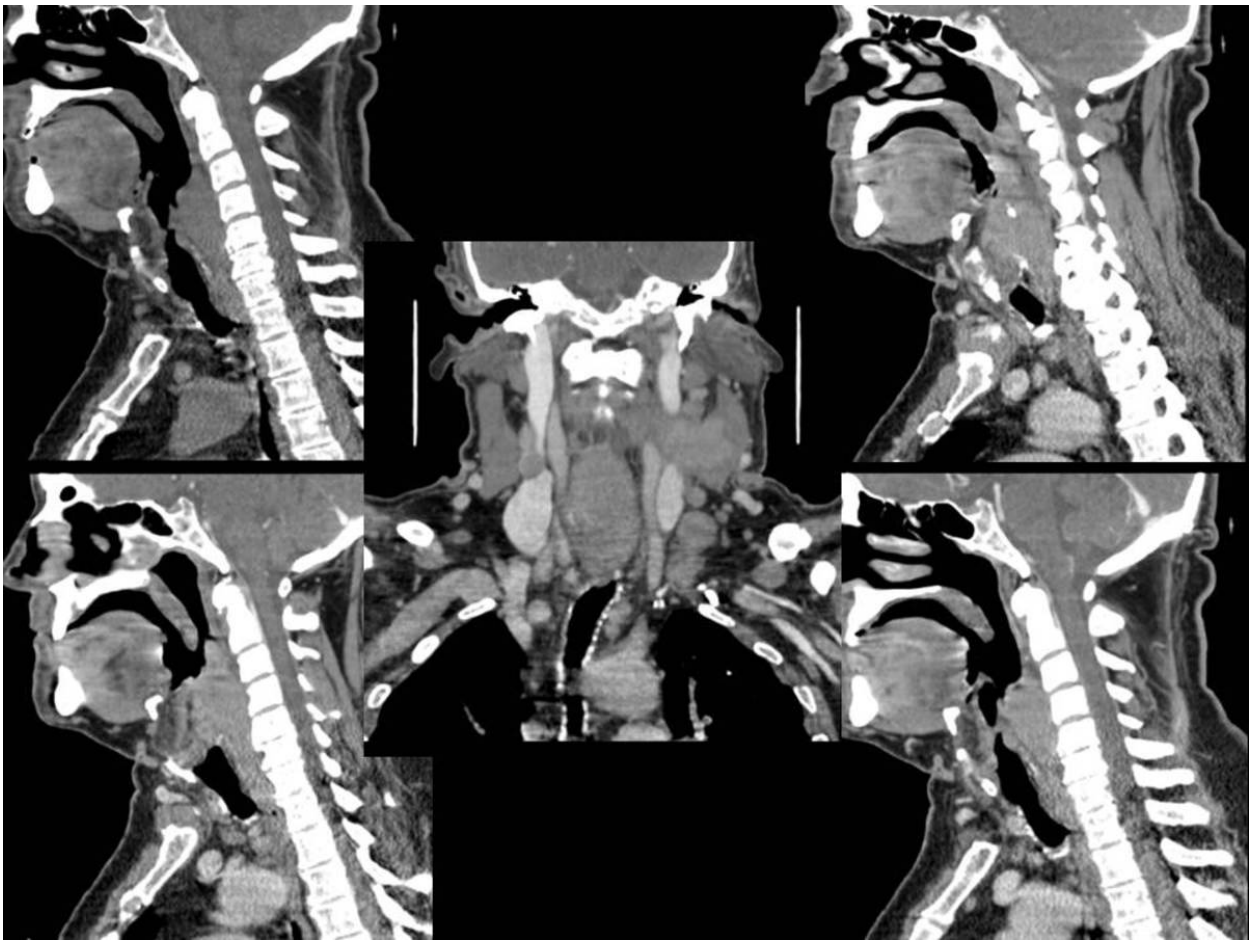

Fig. 38: Squamous cell carcinoma of the pharynx. Same patient from Fig. 37. Sagital and coronal computed tomography images show the posterior extension of the tumor along the retrovisceral and danger spaces and better depict the mass effect that this lesion produces on the airway. Note also the mass effect produced by bilateral adenopathies on the internal jugular veins. Acknowledgment to the Department of Neuroradiology of the Centro Hospitalar do Porto.

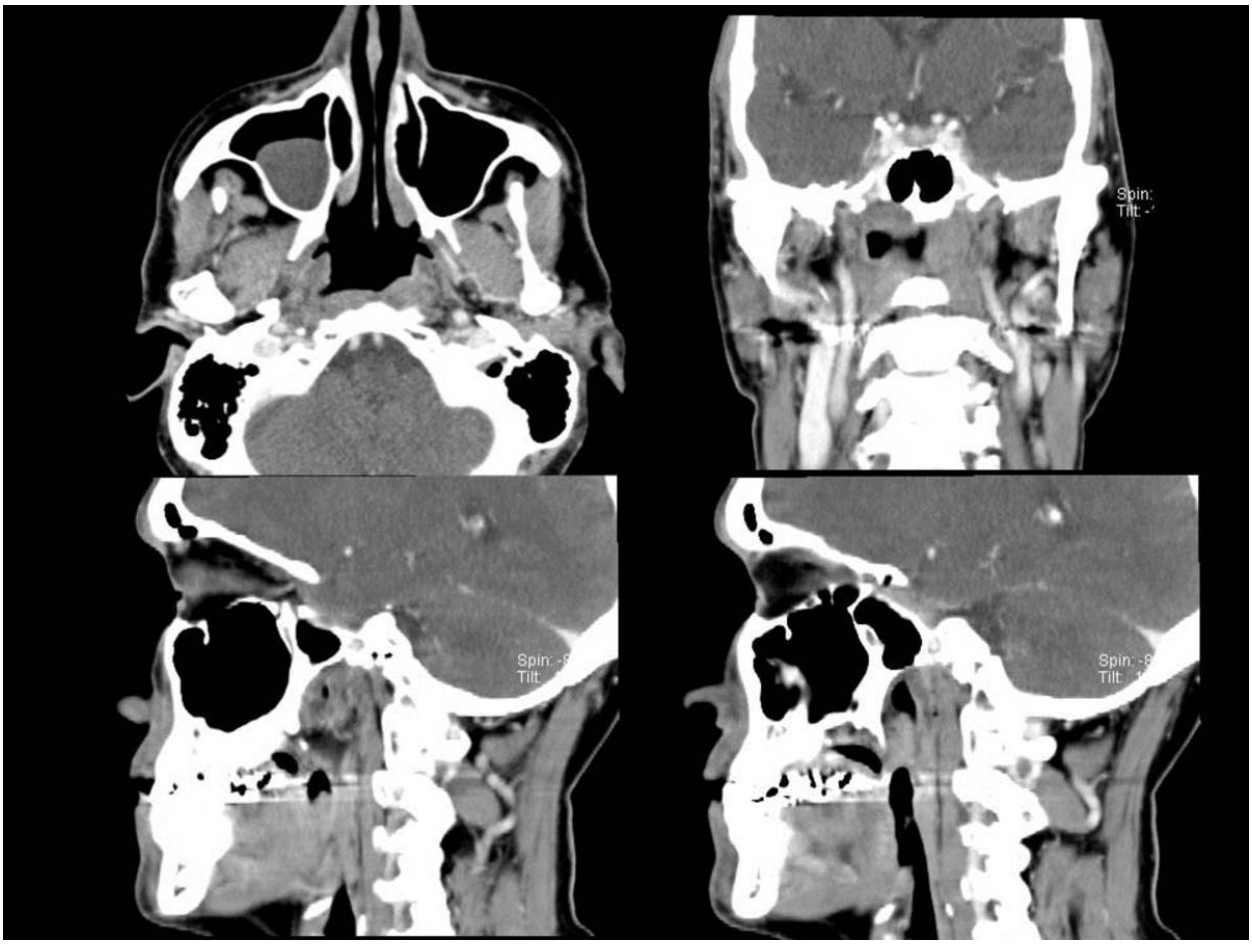

Fig. 39: Undifferentiated carcinoma of the nasopharynx. Axial, coronal and sagital computed tomography images at the level of nasopharynx of a 50 year-old man with an isoattenuating mass occupying the left and part of the posterior walls of the nasopharynx. The mass blunts the left Rosenmüller fossa.

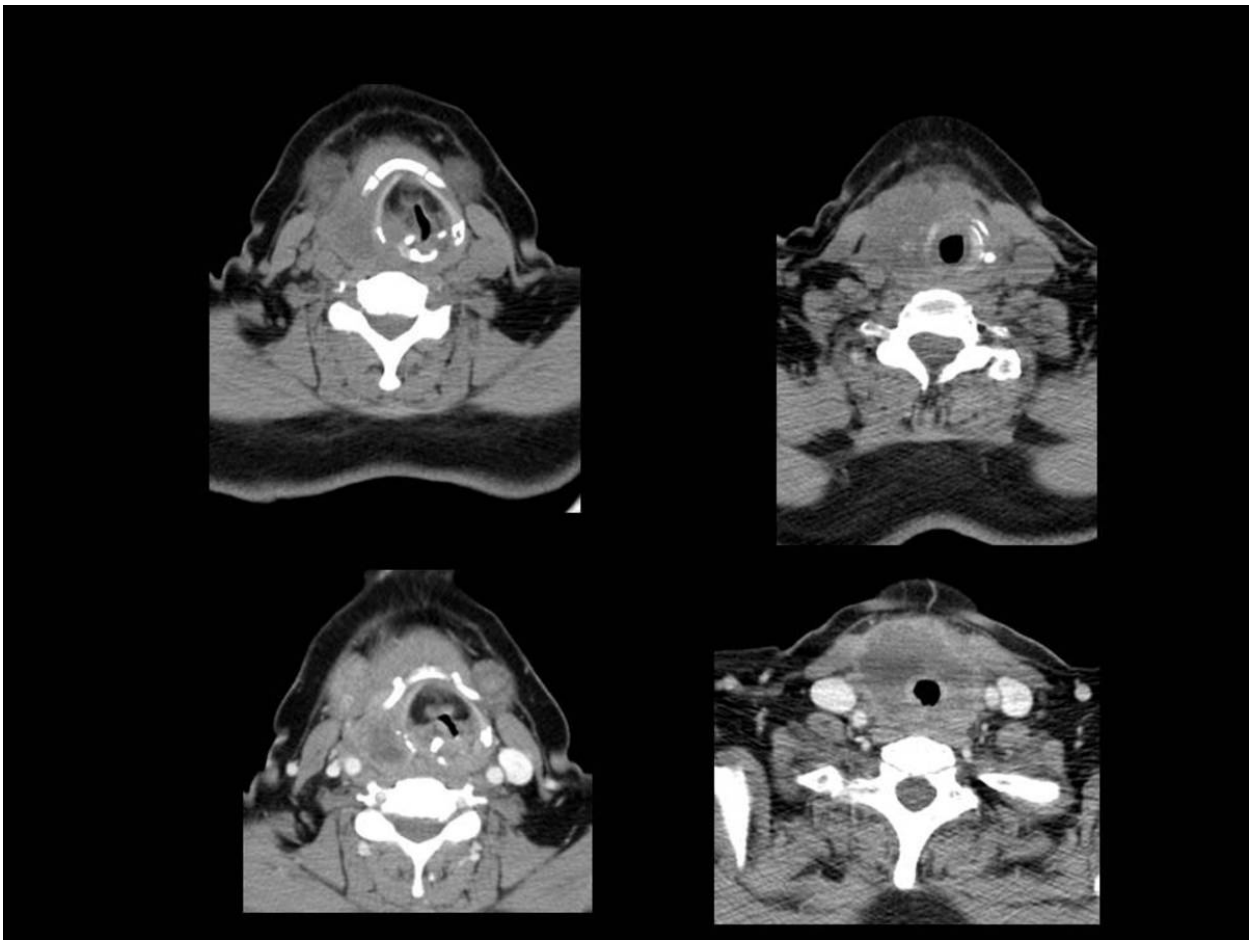

Fig. 40: Anaplastic thyroid tumor. Axial unenhanced (superior) and contrast-enhanced (inferior) CT scan images through the lower neck. Unehnanced images show an heterogeneous tissue replacing and expanding the thyroid gland, with some foci of calcifications inside. After contrast injection, the lesion enhances at the periphery, and the center remains hypoattenuating, suggesting necrosis. The mass has displaced the larynx to the left, invaded it and partly destroyed its cartilage. In fact, this lesion infiltrated all the visceral compartment, the right parapharyngeal space, the danger and the prevertebral spaces, as all involved fat planes are obliterated. All these imaging findings provide evidence of the aggressive nature of this anaplastic thyroid carcinoma as it violates the fascial planes. Acknowledgment to the Department of Neuroradiology of the Centro Hospitalar do Porto.

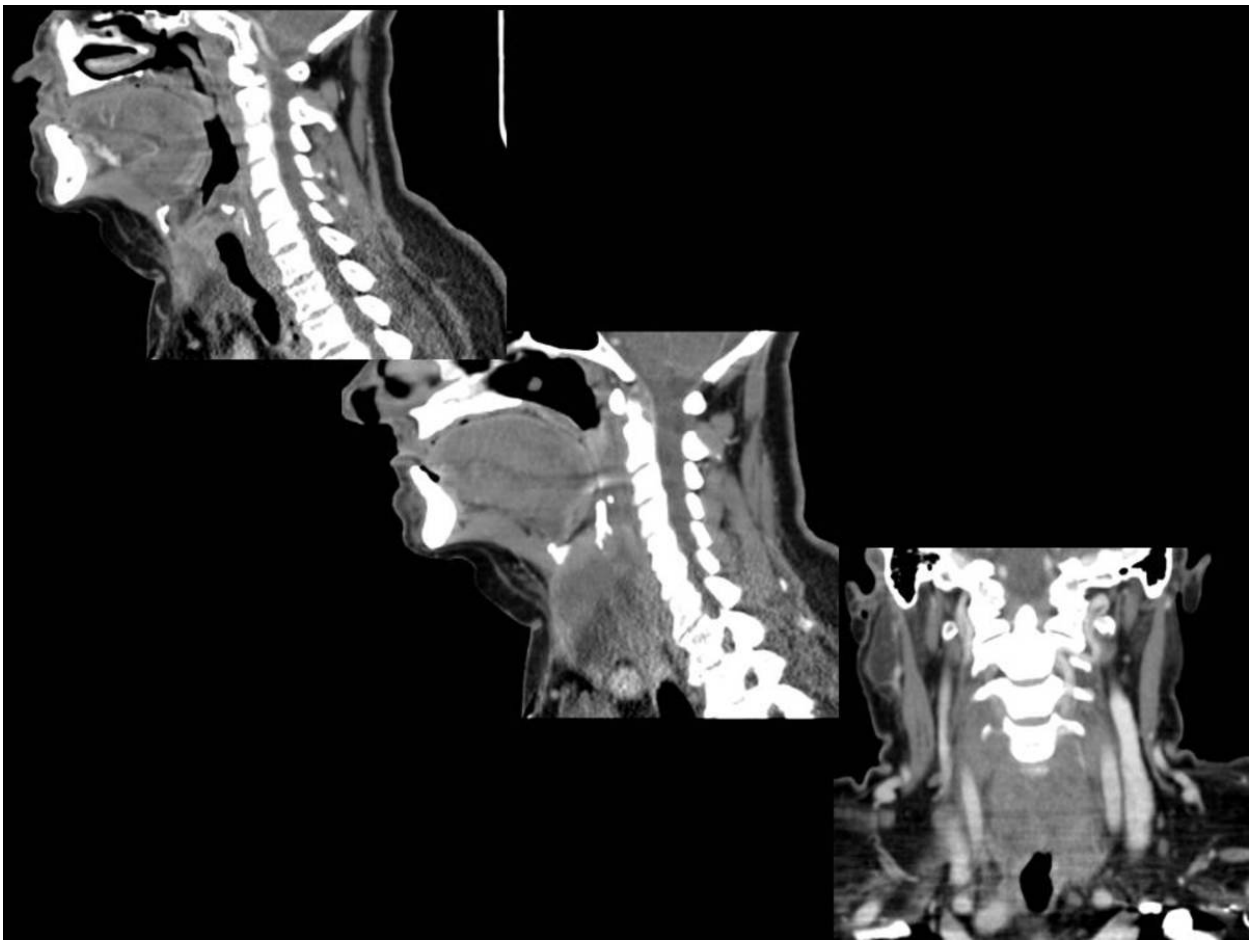

Fig. 41: Anaplastic thyroid carcinoma Sagittal and coronal contrast-enhanced CT scan images of the same patient from Fig. 40, clearly depicts the invasion of the entire infra-hyoid visceral compartment. There are also no fat planes between it and the prevertebral muscles, meaning infiltration of the danger and prevertebral muscles. Note the thyroid cartilage invasion (middle image). Acknowledgment to the Department of Neuroradiology of the Centro Hospitalar do Porto.

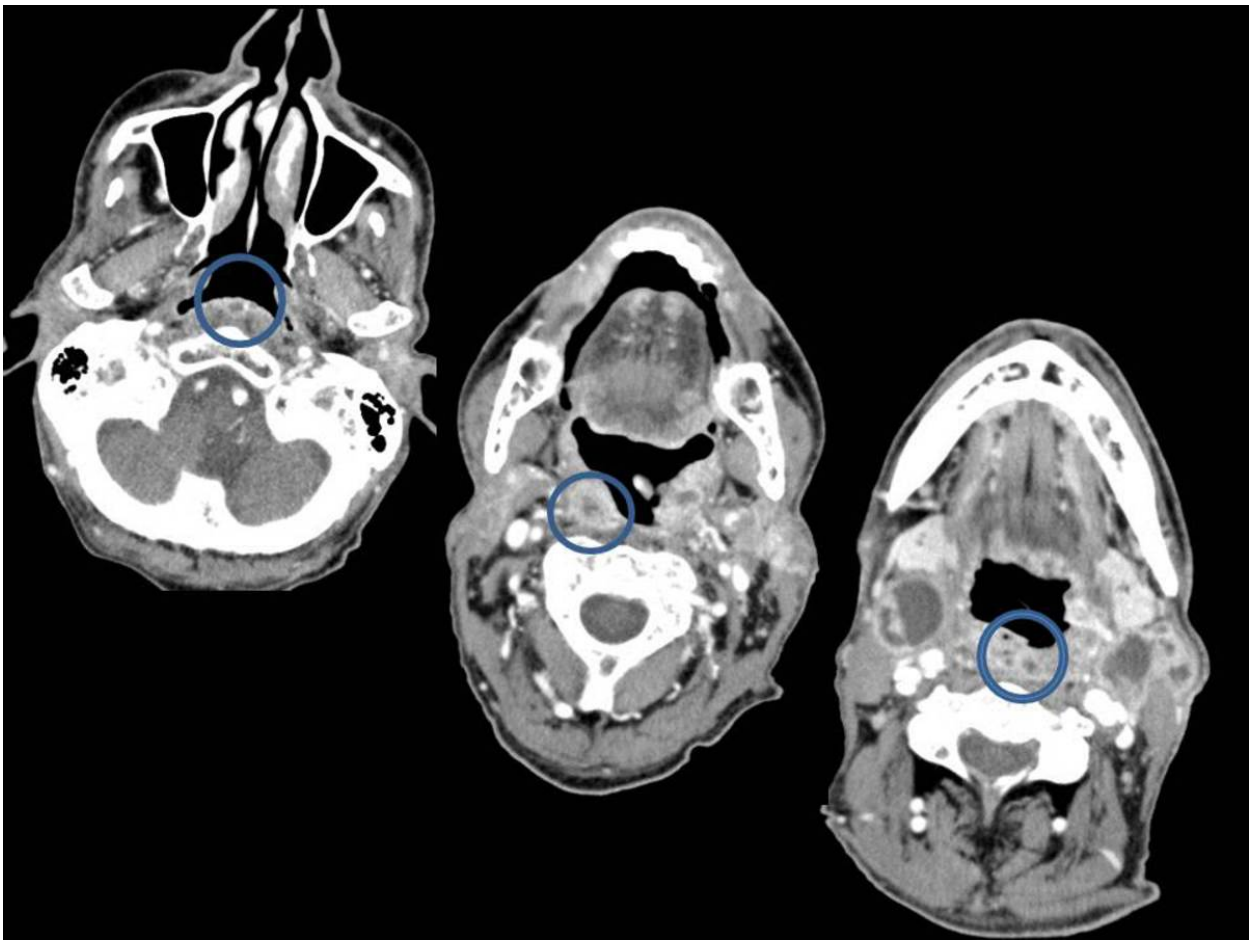

Fig. 42: Metastatic adenopathy from a tonsilar carcinoma. Axial enhanced computed images: -left image: retropharyngeal node with central hypodensity and peripheral enhancement - necrotic lymphadenopathy. - middle image: large, necrotic right lateral retropharyngeal lymph node with irregular enhancing margins, surrounded by increased attenuation fat - extracapsular lymphadenopathy. - right image: retropharyngeal necrotic lymph node cluster.

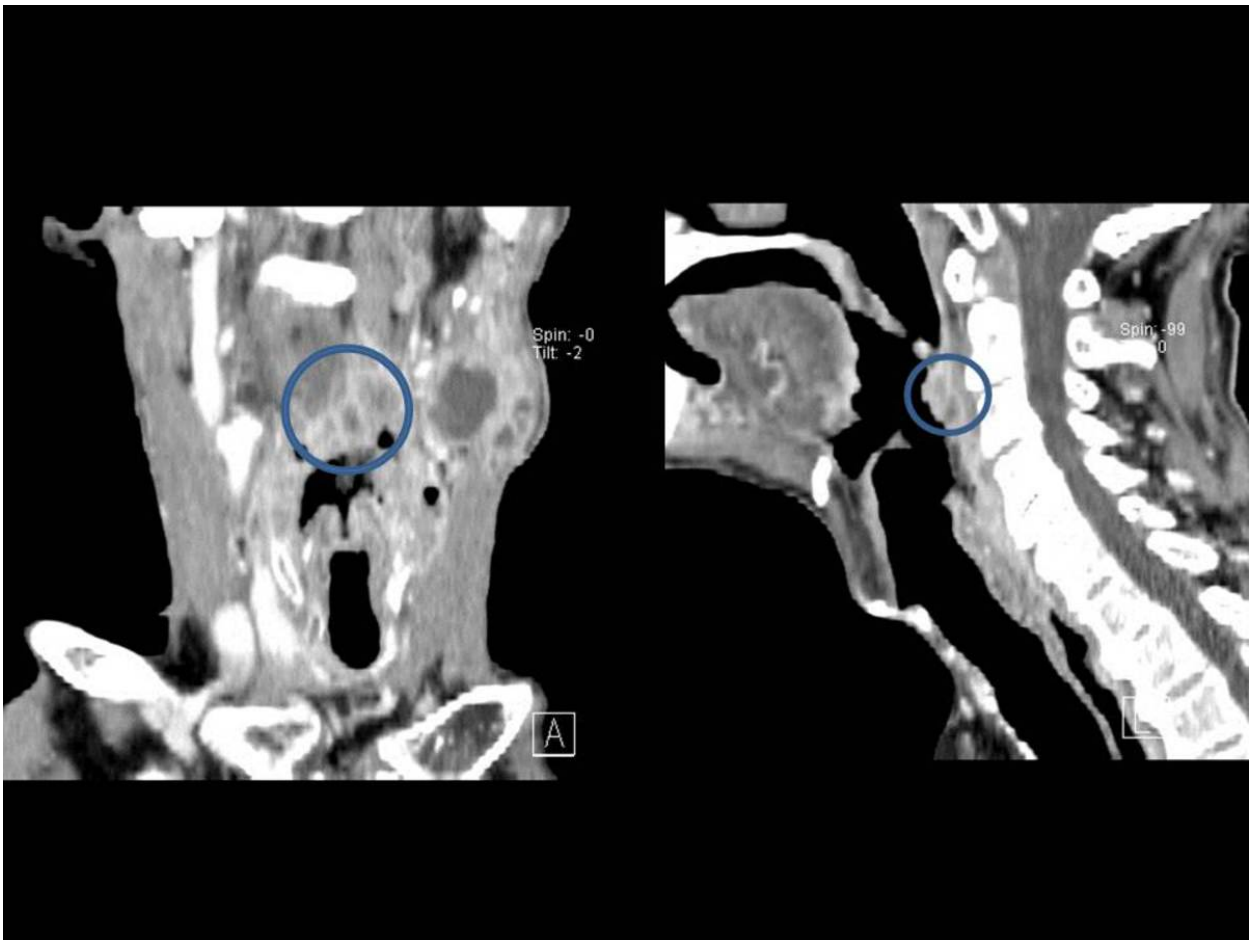

Fig. 43: Metastatic adenopathy from a tonsilar carcinoma. Coronal and sagital enhanced computed tomography images of the same patient of Fig. 36 showing the retropharyngeal necrotic lymph node cluster.

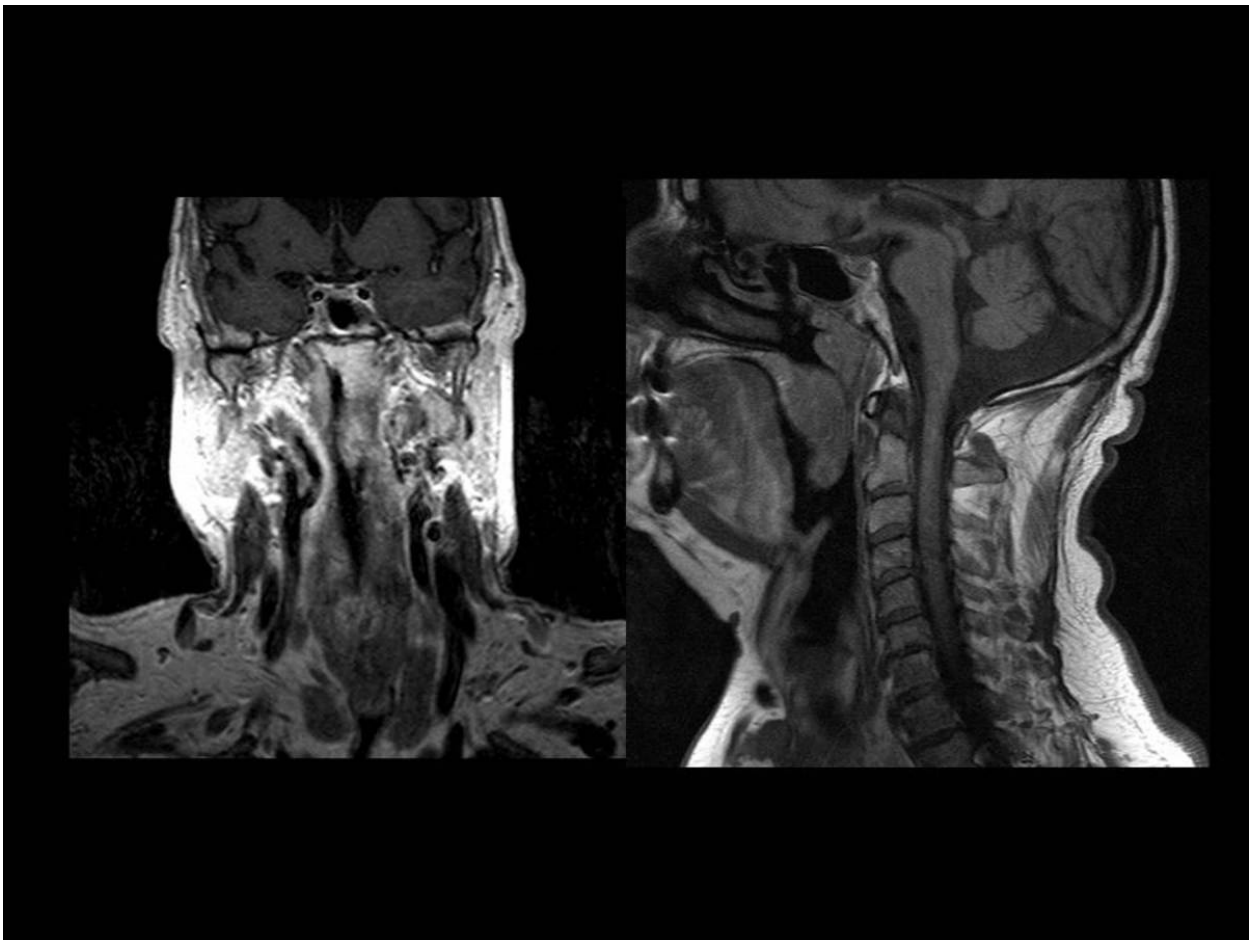

Fig. 31: Nasopharyngeal hemangioma. Same patient from Fig.29. Coronal enhanced T1-weighted image and sagittal unenhanced T1 weighted image: the homogenously enhancing mass occupies the cavum and contacts the cortical bone of the skull base.

Conclusion

To retrieve the most of MDCT and MR information, radiologist should have a comprehensive knowledge of the anatomy and be aware of the spectrum of potential findings and their etiologies in retrovisceral and danger spaces:

1. The visceral compartment and the danger space are good routes for spread of infections originating in head and upper portion of neck to the mediastinum.
2. Because the alar fascia is very thin, the *danger and the retropharyngeal spaces cannot be distinguished By imaging* in a healthy patient.
3. The retrovisceral space may be infected by posterior perforation of pharynx or oesophagus, by retropharyngeal lymph node drainage of infections from other spaces, direct extension of pretracheal space's affection, danger space´s infection or infection of the posterior mediastinum.
4. There are no lymph nodes in the infra-hyoid portion of the retrovisceral space.
5. Respecting the normal topography of the medial and lateral retropharyngeal nodes, the retropharyngeal adenopathies soare the midline.
6. The pretracheal space can get infected from retrovisceral space, around the sides of pharynx, esophagus and thyroid gland between the levels of the oblique line of thyroid cartilage and the inferior thyroid artery. From here the infection can reach the anterior mediastinum.
7. The visceral fascia can prevent tumor from spreading into deeper spaces in the neck, being sometimes a potential resistance to tumor spread.
8. Since the danger space is closed superiorly, inferiorly and laterally, infections must enter the space by penetrating its walls.
9. Retrovisceral affections can break through the posterior wall of the space (through the alar fascia), and can enter the danger space.
10. Through danger space an infection can easily travel to the thoracic cage and posterior mediastinum.

The majority of lesions occupying the retrovisceral and danger spaces can be diagnosed with MDCT, without need of other imaging studies.

MDCT is also an important tool for the accurate definition of the extension of processes which may have important therapeutic implications and change patient's management and outcome, particularly in emergency.

Personal Information

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