Anatomical Considerations for the Interpretation of a Computed Tomography Chest Scan

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Abstract

Introduction: The learning of anatomy in the degree course of the general practitioner should be carried out with the ultimate goal of knowing and guiding the interpretation of normal anatomical structures, helping the future. Professional to evaluate, diagnose and, in some cases, even treat certain pathologies. This is especially true when we add to the medical practice the use of diagnostic imaging methods, such as Computed Tomography [CT]. This technology is very useful in the evaluation and diagnosis of thoracic pathologies.

Objectives: To generate a comparison between the cadaveric study material and images of a computed tomography in order to facilitate the interpretation of the latest.

Materials and Methods: When working in this project we used a non-pathological chest CT scan. It was studied, cut by cut, looking for important anatomical structures at the time of diagnosis or treatment of relevant pathology (either by prevalence or gravity), then it was contrasted with cadaveric thoracic cross sections conserved in Formaldehyde.

Results: A reliable comparison of the anatomical parts of the thoracic cavity in the corps with its tomographic counterparts was obtained.

Conclusion: The correct understanding and application of the human anatomy is fundamental for the correct use of imaging studies, these being in many times critic for the correct interpretation of the problems that afflict the patient.

Keywords: Computed tomography; Chest; Mediastinum; Interpretation; Anatomy

Abbreviations

CT: Computed Tomography; T: Trachea; E: Oesophagus; RSV: Right Subclavian Vein; RIJV: Right Internal Jugular Vein; BCAT: Brachiocephalic Arterial Trunk; LPCA: Left Primitive Carotid Artery; LSA: Left Subclavian Artery; LBCV: Left Brachiocephalic Vein; RBCV: Right Brachiocephalic Vein; SVC: Superior Vena Cava; AA: Aortic Arch; OF: Oblique Fissure; RA: Right Atrium; RAA: Right Atrium Appendage; RV: Right Ventricle; LA: Left Atrium; LAA: Left Atrium Appendage; HF: Horizontal Fissure; LV: Left Ventricle

Introduction

The learning of anatomy in the degree course of the general practitioner should be carried out with the ultimate goal of knowing and guiding the interpretation of normal anatomical structures, detaching the possible alterations that may occur, helping the future.

Professional to evaluate, diagnose and, in some cases, even treat certain pathologies. This is especially true when we add to the medical practice the use of diagnostic imaging methods, such as Computed Tomography [CT].

CT is the method that provides more information about the whole thorax, allowing simultaneous evaluation of the lungs, the pleura, the mediastinum and the chest wall (including adjacent bone, muscular and articular structures). The presence of iodinated contrast facilitates the visualization of cardiac structure and vascular elements.

This method is very useful in the evaluation and diagnosis of thoracic pathologies, being superior to conventional radiography and magnetic resonance imaging; and even, in certain cases, it allows to carry out what is known as imaging intervention for diagnostic and therapeutic purposes.

However, the correct interpretation of a tomography requires the precise knowledge of the normal anatomy of the thorax, the topography and relationships of each structure, in order to identify the alterations that may occur. It is at this point where the difficulty is usually presented in the undergraduate student, since the acquisition of knowledge in anatomy is very distant in time to the acquisition of knowledge in diagnostic imaging, preventing comparative learning [1-4].

Objective of the Study

General objective: Generate a comparison between the cadaveric material and images of a computed tomography in order to facilitate the interpretation of the latter.

Specific objectives

- Identify normal anatomical structures and topographic areas of relevance in a cadaveric piece.

- Understand the relationship between anatomy and pathological processes, and how they translate to the CT images.

Materials and Methods

When working in this project we used a non-pathological chest CT scan. It was studied, cut by cut, looking for important anatomical structures at the time of diagnosis or treatment of relevant pathology (either by prevalence or gravity), then it was contrasted with cadaveric thoracic cross sections conserved in Formaldehyde.

Results and Discussion

For the comparative study, 10 axial CT cuts were selected, taking into account that these are the most relevant when interpreting a chest CT.

We began the comparison from the top and continue downwards while commenting on the different structures of relevance and their important relationships. In the annexes are the photos that are referenced in the text, they are arranged so that the first column is the anatomical cadaveric cross section, the second column the tomographic cut in window for the pulmonary parenchyma and the third the tomographic cut in window for mediastinum.

The first section of relevance (Figure 1) is at the height of the second thoracic vertebra, in the right lung field the apical segment (I segment) can be observed, while in the left lung field we see the apicoposterior segment (I-II segment). In the mediastinum the trachea [T] is found as a central structure and in close posterior proximity lays the oesophagus [E]. The vessels that emerge from the aortic arch

and the veins that are coming to form the superior cava vein are surrounding the trachea, from right to left they are: right subclavian vein [RSV], right internal jugular vein [RIJV], brachiocephalic arterial trunk [BCAT], left primitive carotid artery [LPCA], left subclavian artery [LSA] and left brachiocephalic vein [LBCV].
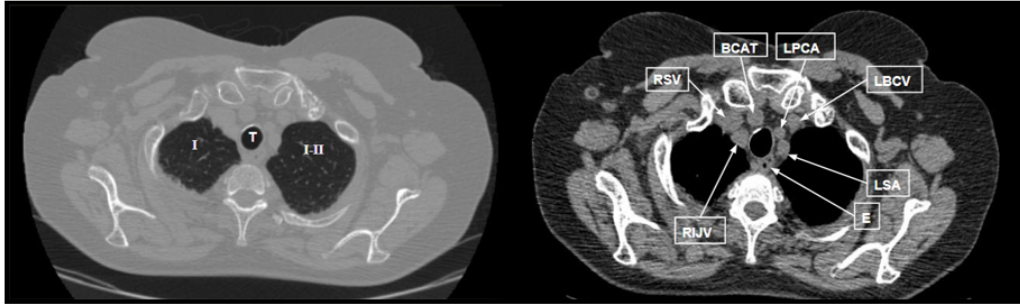

Figure 1

The following section (Figure 2) at the height of the third thoracic vertebra shares much of the previous information, the small changes that can be seen are: a greater representation of the pulmonary fields that now include the dorsal segment of the upper lobe of the right lung (II segment), the arterial trunks are more clustered in the centre of the mediastinum, the LBCV migrates to the right and the RSV joins the RIJV giving rise to the right brachiocephalic vein [RBCV].
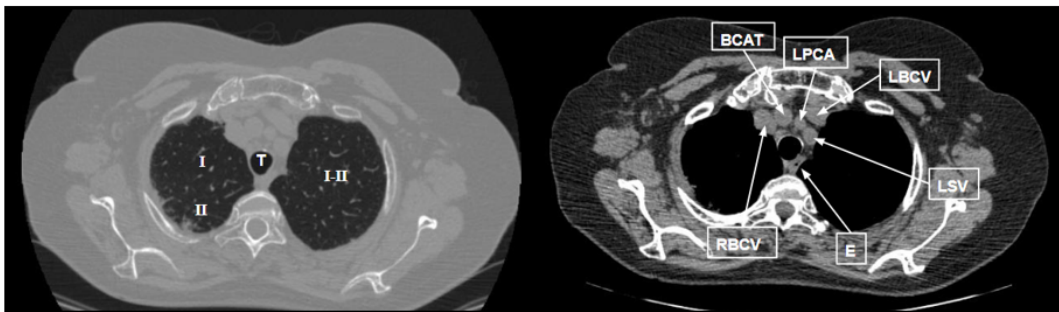

Figure 2

We continue with an image at the height of the fourth thoracic vertebra (Figure 3), where is observed how the venous components converge and form the superior vena cava [SVC], and the arterial components were replaced by the aortic arch [AA]. At the same time, the pulmonary fields extend anteriorly revealing the anterior segments of the superior lobes [III segment], whereas in the right lung the oblique fissure [OF] appears and posteriorly delimits the apicodorsal segment of the Inferior lobe (VI segment).
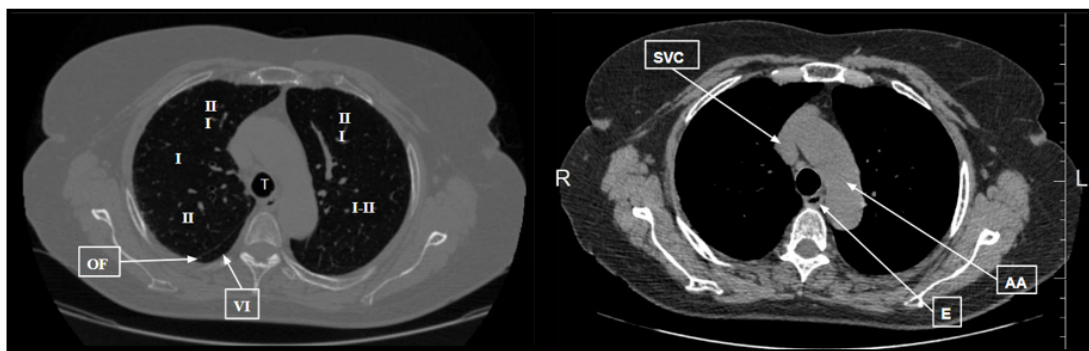

Figure 3

At the height of the fifth thoracic vertebra we see in the mediastinum, above and to the right towards, the ascending aorta [AsA] and to its left the SCV. In the centre the pulmonary trunk [PT] divides into its two branches, the right and left pulmonary arteries [RPA and LPA respectively]. Behind it in order we see the right and left primary bronchi [RPB and LPB respectively], the E and finally the descending aorta [DA] placed next left to the spine. In the pulmonary fields the apical segments disappear and the OF of the left lung appears revealing the apicodorsal segment.
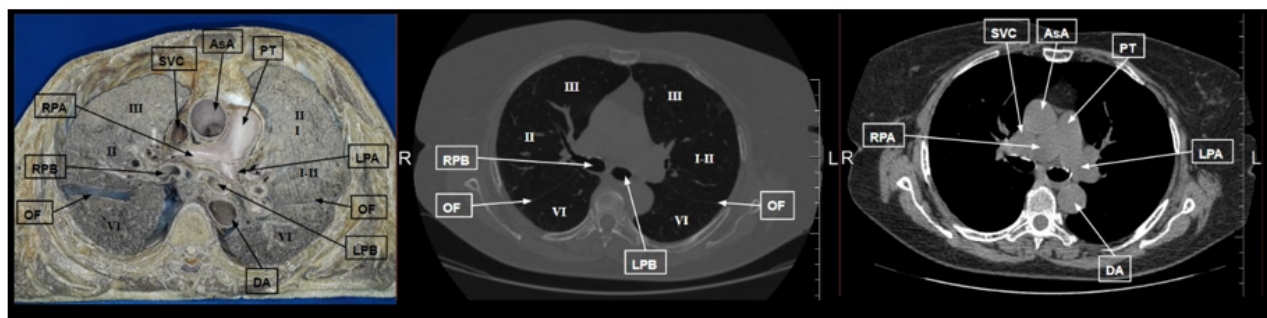

Figure 4

The next image (Figure 5) contains the same information as the previous cut, the main difference being that in this the left lung is projected anteriorly respecting to the heart, and forms the lingula, in it is represented the superior lingula segment (IV segment).
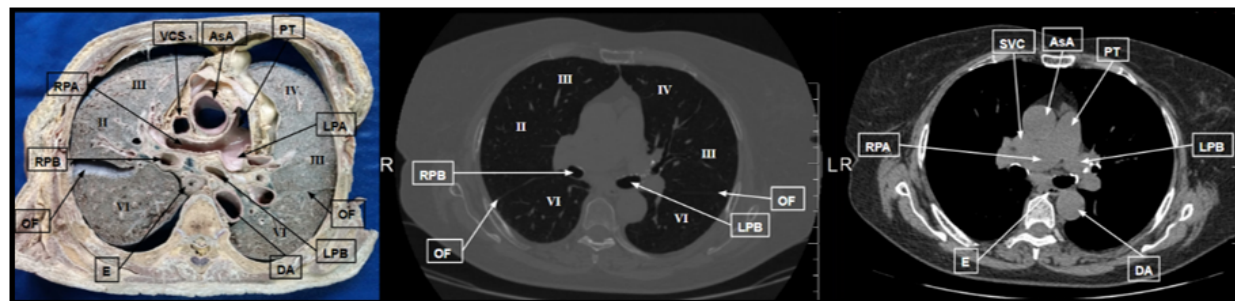

Figure 5

At the height of the seventh thoracic vertebra (Figure 6) we observe n the anterior region of the mediastinum from right to left we observe the upper end of the right atrium [RA] (and its appendage [RAA] that wraps the emergence of the pulmonary artery), the AsA and the upper end of the right ventricle [RV]. To posterior we find the left atrium [LA] that shows intimate and important relationship with the E. In the right pulmonary field, the horizontal fissure [HF] appears and between it and the OF the middle lobe is delimited with its lateral and medial segment (IV and V segments respectively). In the left lung the inferior lingula segment (V segment) appears. While in both inferior lobes the apicodorsal segment disappears to give way to the basal segments, these being the Medial Basal, Anterior Basal, Lateral Basal and Posterior Basal (Segments VII, VIII, IX and X respectively).
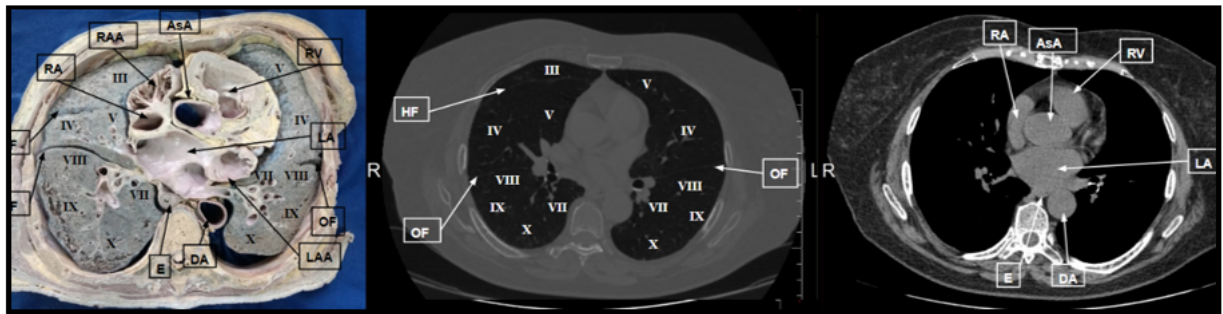
Figure 6

If we continue descending, at the height of the eighth thoracic vertebra (Figure 7) we find that in the mediastinum, the ascending aorta is located in a central position and is surrounded anteriorly by the RV, to the left by the muscle mass of the left ventricle [LV], to the right by the RA and posteriorly by the LA. In this image it is important to highlight the increase in representation of the inferior lobe on the pulmonary fields is, and the disappearance of the right superior lobe.
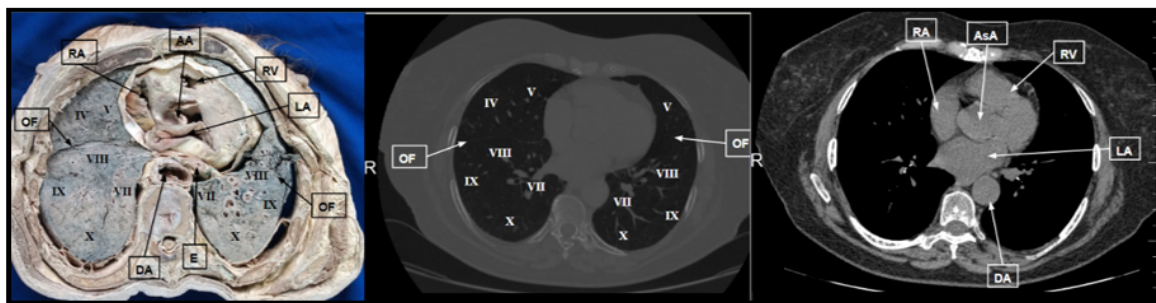

Figure 7

Also, at the height of the eighth thoracic vertebra but a little lower (Figure 8) we observe a cut of the four cardiac chambers and the intimate relationship between the LA and the E. On the left side of the anterolateral face of the vertebral bodies we see the DA. This section already shows how the pulmonary fields are increasingly represented by the Inferior lobes, even leading to the complete disappearance of the lingula.
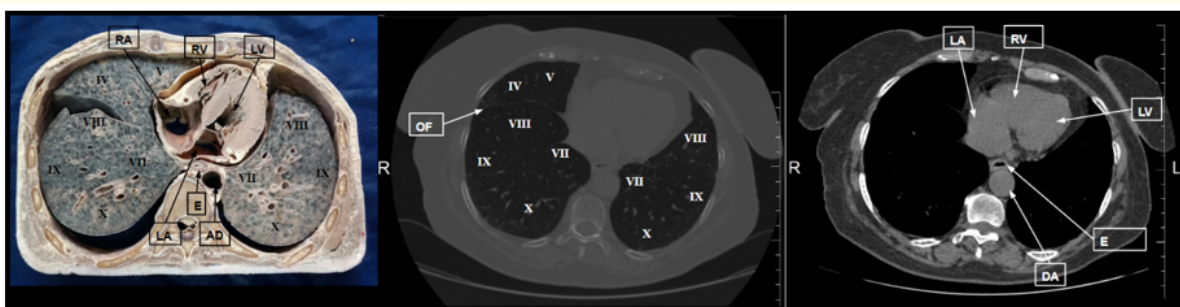

Figure 8

At the height of the ninth thoracic vertebra (Figure 9) the LA disappears, leaving an axial view of the other three cardiac chambers. In the right pulmonary field, the right diaphragmatic dome begins to appear, which, due to the presence of the liver, is more elevated than the left one. Below, at the liver we may find the VIII hepatic segment. In close relation with the liver we see the inferior vena cava [IVC] that is ascending to meet the SVC to form the RA. In addition, this section allows us to clearly see the shape of the pulmonary bases, following the diaphragmatic dome line and ending both anteriorly and posteriorly at a much lower level.
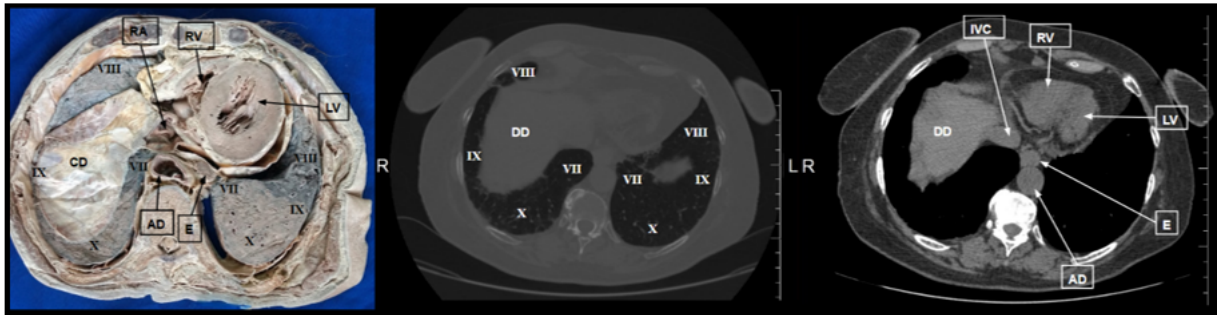

Figure 9

A reliable comparison of the anatomical repairs of the thoracic cavity in the corpse with its tomographic counterparts was obtained, being able to identify all the most relevant structures.

Conclusion

Anatomy, and its correct understanding and application, is essential for the correct use of imaging studies and with it the correct interpretation of the problems that afflict the patient. It is therefore essential that the learning of normal anatomy and its imaging correlate are given together so that in this way the anatomy student, who travels the beginning of the career, can visualize one of the mostly applications of the subject in the medical exercise of the everyday, as it is in this case the diagnosis by images.

Bibliography

1. Webb WR., *et al*. "Fundamentals of Body Ct". Philadelphia: Elsevier/Saunders (2006).

2. CS Pedrosa and R Casanova. "Diagnóstico por imagen. Tratado de Radiología clínica (volúmenes IVII)". Ed. Interamericana-McGraw-Hill, 2nd edition. Madrid (2010).

3. H Rouvière and A Delmas. "Anatomía Humana". 9th edition. Barcelona. Ed MASSON (1996).

4. Drake Richard L., *et al*. "Gray's Anatomy for Students". 41st edition. Philadelphia: Elsevier/Churchill Livingstone (2005).