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Technical Report

A BRIEF DISSECTION'S GUIDE TO NORMAL MEDIASTINAL ANATOMY.

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ABSTRACT

The purpose of this article is to show the mediastinal dissection method used during the stage performed by a group of students from the University of Palermo that, during the summer of 2017, had the opportunity to spend a period of 4 weeks at the Department of Anatomy of the University of Malta. The students were guided to practice dissection of some corpses to study various mediastinal organs. This experience permitted to the students to verify practically what they lernt in the books, and represented a unique opportunity for them to perform practice with cadavers, that is actually very difficult to do in Italian universities.

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1. Introduction

In our university the study of anatomical sciences is basically carried out on anatomical models and books, while at the University of Malta the aforesaid study is carried out also with the important aid of anatomical dissections.

Thanks to an agreement between the University of Malta and the University of Palermo, a group of students was able to go to Malta to carry out a dissection course [1 - 4]. The students have been selected in relation to the good quality of their university career and their excellent knowledge of the English language [5, 6].

The course was held in the Sector Room of the University of Malta where dissections were carried out taking into account all the rules for avoind infection and microbiological contamination [7, 8], and with careful separation of the anatomical structures under the supervision of tutors from both universities.

The aim of this work is to give a brief guide to study the mediastinum, the space between the median surfaces of the pleura, the posterior surface of the sternum and the anterior surface of the vertebral column [9].

This space has the shape of a truncated pyramid with a lower rectangular base flattened in a lateral direction and extended instead in a ventro-dorsal sense and in height. The base of the mediastinum corresponds to the central portion of the diaphragm; the apex corresponds to the base of the neck, the thoracic vertebral bodies and disks form the posterior face, the lateral faces are formed by the right and left mediastinal pleura. The front face is formed by the breastbone. The dimensions of the mediastinum vary in relation to the shape of the thorax, the volume of the lungs and the heart, the patient's age [10].

The mediastinum is located between a complex of organs: the heart with the pericardium, the large vascular trunks, the intermediate and distal part of the extrapulmonary respiratory tract, the thoracic portion of the esophagus, the lymphatic system with the lymph nodes, the nervous trunks.

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The mediastinal space is also filled with a connective that fills the empty spaces between the various organs in such a way that they can assume an anatomical and functional independence [11, 12]. Anatomically and surgically the mediastinum is divided according to a frontal plane in anterior and posterior mediastinum or according to a transverse plane in an upper and lower mediastinum [13].

2. Material and methods

We have studied two cadavers, dead for natural causes. The first one was a cadaver of a 80-years-old man and the second one was of a 75-year-old woman. Moreover, among the used material we also include books and anatomical atlases. In order to perform the dissection we used suitable tools such as: scalpel handle size 4 and blade size 22; Mayo scissors; anatomical and surgical forceps; shears for ribs. During the activities, it was necessary to wear surgical uniform (scrubs), latex gloves, surgical mask, protective glasses, all this in order to protect the operators from the dissection material.

3. Results

The cadavers were placed on the anatomic table, with the head hyperextensioned. The first cut was made by making an incision, called chalice incision, which is drawn starting from the acromion of one side, following the inferior margin of the clavicle, continuing latero-laterally until reaching the contralateral acromion, for this reason it is called incision bisacromiale. For the second cut we proceeded with the median incision going from the jugular incisura, in correspondence with the previous cut, and going downwards along the sternum, passing from the xiphoid process, from the umbilical process, to then follow the bifurcation of the iliacs, becoming in this way the "Y" incision. We removed the skin and subcutaneous tissue with scalpel and forceps, using the "flat" technique; then the first muscles that we interfered with must be dissected and overturned antero-posteriorly: large pectoral, small pectoral and toothed. Then the clavicle is disarticulated from the sternum handlebars by manual operation. To access the mediastinum, we proceeded with costotomy, using a costotome and proceeding in a caudo-cranial sense at the cost-chondral joints. Once the maneuver has been carried out on all the ribs, the plate has to be raised by undoing the xypho-pericardial and sternal-pericardial ligaments with the scalpel; at this point the plate is removed (Figure 1).

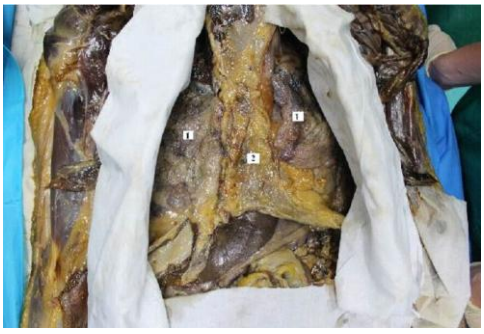

Figure 1. Panoramic anterior view of the mediastinum after removal of the sternum plate. 1: lungs; 2: pericardium.

What we initially see are the lungs laterally, medially the mediastinum with its main structures: the pericardial sac and the large vessels. The next step consists in opening the pericardial sac. This is engraved with a "Y" shaped craniocaudal cut with rounded-tipped shears. After gripping and raising the sternal surface of the sac, using a toothed forceps held on the left hand, a "keyhole" incision of about 2 cm is made towards the lower part of the sac, above the frenic limit of the pericardium. After the keyhole incision, first we proceeded with another sagittal incision of the superficial layer of the pericardium towards the point of reflection of the heart; then, always starting from the keyhole incision, we made two large oblique incisions directed respectively to the right and to the left, obtaining an oblique incision of the pericardial sac. Finally, a third oblique incision of the pericardial layer is made through the acute margin of the heart.

Once the pericardium has been opened, it is possible to evaluate the internal surface of the pericardium where its adhesions with the surrounding structures are evident. In this case a pericardial inflammation was found which needed a maneuver of "Digitoclasia", by which the adhesions between the pericardium and the external surface of the heart were removed (Figure 2 and 3).

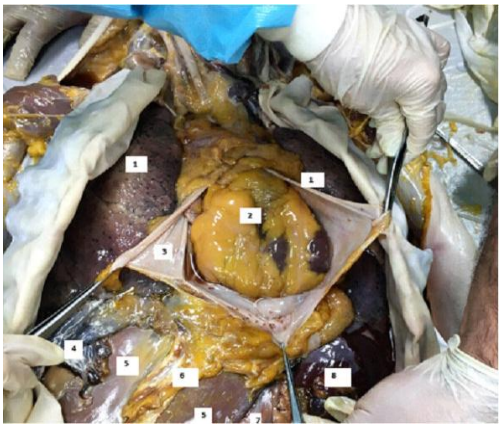

Figure 2. Opening of the pericardium and vision of the heart. 1: lungs; 2: heart; 3: pericardial sac; 4: diaphragm; 5: liver; 6: falciform ligament; 7: stomach; 8: spleen.

Figure 3. Manual separation (digitoclasia) between the pericardium and the external surface of the heart.

Subsequently, it is possible to clearly visualize the heart with the origin of the great vessels, in particular the right structures of the heart and the ascending aorta are clearly visible from the front. We proceeded with complete isolation of the cardiac structure respect to the pericardial sac and adjacent structures, proceeding laterally and posteriorly using scissors and anatomical forceps. Once the cardiac structure has been mobilized, we continued the same isolation procedure in order to remove the adhesions between the large vessels and the surrounding structures. Regarding the heart we visualize the cardiac chambers, in particular right atrium and right ventricle in the foreground, and proceeding from left to right the most anterior portions of the left cardiac chambers; at the atrioventricular and interventricular furrows we find the presence of adipose tissue. Frontly we see the coronary structures such as the right coronary artery, which originates from the ascending aorta at the sinus of Valsalva (near the aortic valve); along the interventricular furrow, the anterior descending artery runs up to the sharp edge of the incision. This artery originates from the common trunk, from which also arises the posterior circumflex artery, which runs on the left atrioventricular furrow (Figure 4).

Figure 4. Heart and large vessels. 1: left carotid artery; 2: left subclavian artery; 3: brachiocephalic arterial trunk; 4: ascending aorta; 5: aortic arch; 6: pulmonary artery; 7: right ventricle; 8: lungs; 9: superior vena cava; 10: right brachiocephalic venous trunk; 11: left brachiocephalic venous trunk; 12: right coronary artery; 13: left posterior circumflex

At the upper heart margin, we find the ascending aorta and the pulmonary artery: the first one originates at the aortic semilunar valve, which communicates with the left ventricle, the second one communicates with the right ventricle and originates from the pulmonary semilunar valve. Within the ascending branch the presence of large atherosclerotic plaques is found. The ascending aorta continues with the aortic arch, to which the descending aorta occurs.

From the aortic arch branches the brachiocephalic trunk, from which the right subclavian artery originates. Regarding the venous component, we note the superior vena cava, which drains the blood from the systemic circulation into the right atrium. It has lateral relationship with the right lung and anteriorly with the ascending aorta (Figure 5).

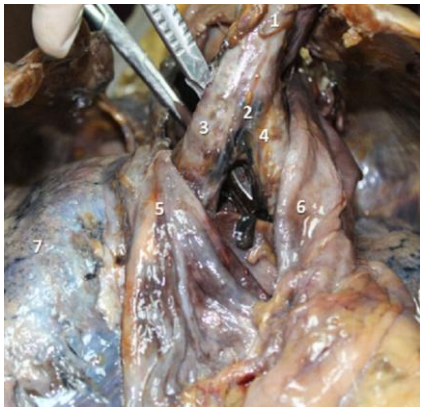

Figure 5. Detail of figure 4. 1: trachea; 2: carena; 3: right main bronchus; 4: left main bronchus; 5: ascending aorta; 6: pulmonary artery; 7: right lung

By manually moving the main vascular structures on the upper side of the heart, the tracheal structure, in close relation with the ascending artery and the pulmonary arteries, is highlighted by means of an anatomical forceps. Particularly noticeable is the lower tracheal portion with the hull and the bifurcation in the two main bronchi.

By raising the heart, it is possible to highlight the posterior margin of the left ventricle and of the right atrium in relation with the inferior vena cava and the pulmonary veins (Figure 6).

Figure 6. Some details of the heart are highlighted. 1: heart; 2: right atrium; 3: pulmonary veins; 4: inferior vena cava.

Once the detachment maneuvers have been completed and most of the adhesions have been removed, we will be able to appreciate the structures of the mediastinum and the relationships of the organs contained in it with the surrounding structures.

At the back of the heart, at the top we notice the big bronchi and closer to the heart we have the esophagus.

Behind the esophagus there is the retro-esophageal space, through which, in particular situations, infections coming from the oral cavity can spread, moving in the retropharyngeal space and then retroesophageal and therefore give mediastinitis (Figure 7).

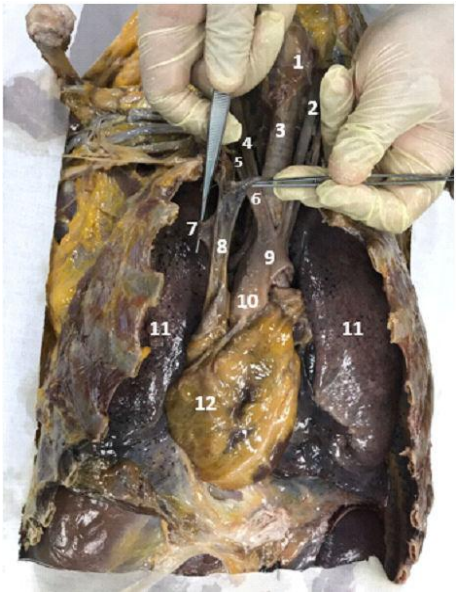

Figure 7. Other details of the large vessels of the hear. 1: thyroid cartilage; 2: left carotid artery; 3: trachea; 4: right carotid artery; 5: right subclavian artery; 6:brachiocephalic arterial trunk; 7: vena azygos; 8: superior vena cava; 9: aortic arch; 10: ascending aorta; 11: lungs; 12: heart.

4. Discussion and conclusions

This article highlights the benefits of a practical approach to anatomical studies considering the dissection of cadavers as a step following the theoretical studies. Thanks to the use of atlases, anatomy books and techniques acquired during the course, the structures of the human body were compared with the information previously acquired through our studies of an exclusively theoretical nature. The study of the structures on multiple bodies, in a comparative perspective, has been extremely useful, because it allowed us to visualize anatomical variations in the subjects studied. The study of the mediastinum in particular with the visualization of the relationships between vessels, nerves and viscera allowed us to acquire greater awareness of the structures from the morphological-functional point of view, which will be valuable in understanding the pathologies connected to them. We hope that in the future this will not remain an opportunity for the few, but will become the practice for all students, in order to strenghten the practical component of students' knowledge in medicine.

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