ITMIG classification of mediastinal anatomy: exposure through augmented reality

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Learning objectives
• To make known the ITMIG classification in the radiological community.
• To reduce the inaccuracy of the location of pathologies in the mediastinum.
• To show through CT images and interactive illustrations with augmented reality, the new classification of mediastinal anatomy.

Abstract 14.

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Background
The division of the mediastinum into compartments is useful for an adequate identification, characterization and management of mediastinal pathologies. The most widely used classification is based on the division of the mediastinum through lateral x-ray anatomy, however, the evaluation and management of mediastinal pathology is based mainly on computed tomography (CT) and magnetic resonance imaging. The ITMIG (International Thymic Malignancy Interest Group) classification system seeks to provide a system for cross-sectional images based on anatomical structures, comprising 3 compartments of the mediastinum."
1.1 Prevascular compartments: The boundaries are defined by

- Superiorly: Thoracic inlet.
- Inferiorly: diaphragm.
- Anteriorly: the posterior border of the sternum.
- Laterally: parietal mediastinal pleura
- Posteriorly: the anterior aspect of the pericardium as it wraps around the heart.

The mayor contents of this compartment include the thymus, fat, lymph nodes and the brachiocephalic vein.

The most common abnormalities found in the prevascular compartment include:

- Thymic lesions: cyst, hyperplasia, and malignancy such as thymoma, thymic carcinoma and neuroendocrine neoplasm.
- Germ cell neoplasm.
- Lymphoma.
- Metastatic lymphadenopathy.
- Intrathoracic goiter [1].

1.2 Visceral Compartments: the boundaries are defined by

- Superiorly: Thoracic inlet.
- Inferiorly: diaphragm.
- Anteriorly: the posterior boundaries of the prevascular compartment.
- Laterally: parietal mediastinal pleura.
- Posteriorly: Vertical line 1 cm posterior to the anterior margin of the spine.

The mayor contents of this compartments include:

- Vascular structures: The heart, superior vena cava, ascending thoracic aorta, aortic arch, intrapericardial pulmonary arteries and thoracic duct
- Nonvascular structures: traquea, carina, esophagus and lymph nodes.

The most common abnormalities found in the visceral compartment include:

- Lymphadenopathy: lymphoma and metastatic disease.
- Duplication cysts.
- Traqueal lesions.
- Esophageal neoplasm.
- Vascular lesions arising from the heart, pericardium and great vessels [1].

1.3 Paravertebral Compartments: the boundaries are defined by

- Superiorly: Thoracic inlet.
- Inferiorly: diaphragm.
- Anteriorly: the posterior boundaries of the visceral compartment.
- Laterally: parietal mediastinal pleura.
- Posteriorlaterally: a vertical line along the posterior margins of the chest wall at the lateral aspect of the transverse processes.

The mayor contents of this compartments include

- Thoracic spine.
- Paravertebral soft tissues.

The most common abnormalities found in the visceral compartment include:

- Neurogenic neoplasm: that arise from the dorsal root ganglia.
- Infectious: discitis and osteomyelitis.
- Traumatic origin: hematoma.
- Miscellaneous lesions: extramedullary hematopoiesis [1].
Figure 1.
Prevascular compartment illustration. The mayor contents of this compartment include the thymus, fat, lymph nodes and the brachiocephalic vein. References: - Santiago/CL

Figure 2.
Visceral compartment illustration. The mayor contents of this compartments include • Vascular structures: The heart, superior vena cava, ascending thoracic aorta, aortic arch, intrapericardial pulmonary arteries and thoracic duct • Nonvascular structures: trachea, carina, esophagus and lymph nodes. References: - Santiago/CL
**Findings and procedure details**

**Augmented reality**
Is a live view of a physical, real-world environment related to elements generated by computer. It allows users to experience their surroundings at the same time they are viewing virtual information. Virtual reality unlike the augmented reality replaces the real world with a simulated one.

Augmented reality supplements the real world with virtual objects, which appear to coexist in the same space as the real world.

With the help of advanced augmented reality technology, the information about the surrounding real world becomes interactive and digitally manipulable [2-3].

**Education and augmented reality**
Student can use augmented reality to construct new understanding based upon their interactions with virtual objects, which bring underlying data to life [2-3].

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**Figure 3.**
Paravertebral compartment illustration. The major contents of this compartment include thoracic spine and paravertebral soft tissues.

**Figure 4.**
Augmented reality instructions. 1. Login to AppStore (iOS) or Google Play Store (Android) on your smartphone 2. Install the Zappar app 3. Open the app and select "Get Started" 4. Scan the "GET ZAPPAR" image in the figure 5
Conclusion

- The mediastinum contains vascular, non-vascular structures and organs. It is located in the center of the thoracic cavity. The ITMIG classification system separates the mediastinum into 3 compartments: the pre-vascular, the visceral and the paravertebral. Images are presented that exemplify their limits, modification of spaces in relation to mediastinal masses and the tools of the ITMIG system are presented for the identification of the origin compartment in lesions in which this is doubtful.
- Augmented reality provides opportunities for more authentic learning, giving students a more personalized and explorative learning experience.
- Augmented reality is in the early stages of application within healthcare education but it has enormous potential for promoting an authentic learning experience, achieving core competencies, such as decision making and effective teamwork in healthcare.
- This technological tool can be used for interactive learning techniques on simulation procedures, among others.

References


Figure 5.
Tracking image for augment reality. In the prevascular compartment an homogenous mass corresponding to a thymoma is observed. In the visceral compartment a multiple masses corresponding to a Mediastinal adenopathy for lymphoproliferative disease is observed. In the paravertebral compartment a mass adjacent to the vertebral bodies corresponding to a neurogenic tumor is observed. References: - Santiago/CL