

Cadaver as a didactic tool for auscultating lung sounds

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ABSTRACT

INTRODUCTION: Lung auscultation is one of the basic physical examination tests both in the pre-hospital and hospital settings and should be performed on any patient who has problems with the respiratory system. Depending on the condition, clinicians can hear different breathing sounds. Our aim is to assess the effectiveness of lung auscultation on cadavers.

MATERIAL AND METHODS: The study was conducted in October 2018, among 27 Emergency Medical Services (EMS) students at the University of Natural Sciences and Humanities in Siedlce. The research tool used in this study was prepared human cadaver. Students listened to four pulmonary fields (apices and bases) using a stethoscope.

RESULTS: The study included 27 students with an average age of 21.76 (SD ± 3.20). The average auscultation results were: right lung at the apex - 59.26% (SD ± 49.14), right lung at the base - 96.30% (SD ± 18.89), left lung at the apex - 40.74% (SD ± 49, 14), left lung at the base - 77.78% (SD ± 41.57). The average satisfaction score on a scale from 1 to 5 was 4.37 points (SD ± 1.13).

CONCLUSIONS: The study showed that conducting classes on mannequins is not sufficient for effective auscultation of pulmonary fields, which could probably be obtained through practice on cadavers. Students showed a high level of satisfaction with participation in the study. In order to improve the quality of students' education and practical skills, periodic classes on cadavers should be conducted.

KEY WORDS: Pulmonary auscultation, lung sounds, cadavers, education, learning

INTRODUCTION

One of the basic physical examination tests both in pre-hospital and hospital settings is pulmonary auscultation [1]. Pulmonary auscultation should be performed on every patient who has difficulty in breathing or who is showing symptoms of hypoxia, which may include low saturation, high or low concentration of carbon dioxide in the exhaled air or central cyanosis. Patients may be diagnosed with various respiratory afflictions such as Chronic Obstructive Pulmonary Disease (COPD), pulmonary edema or asthma [2, 3, 4]. However, proper lung auscultation and effective diagnosis of lung sounds requires proper training of medical personnel [5, 6].

Lung auscultation is carried out mainly using the stethoscope. Usually, four lung fields are auscultated: two apices and two bases. This procedure should be done symmetrically to have a comparison between the right and left lung. Depending on the occurrence of respiratory affliction, the most common may be found in the following lung sounds [1, 7, 8]:

- Alveolar - normal, physiological;
- Quiet murmur – e.g. pneumothorax, fluid in the pleural cavity;
- No murmur – e.g. pneumothorax, fluid in the pleural cavity, lack of lung;
- Rales (crackling sounds) – e.g. pulmonary edema, pneumonia;
- Inspiratory wheezing – e.g. laryngitis, tracheitis, foreign body in the airways;
- Stridor (larynx) - e.g. larynx or trachea obturation;
- Expiratory wheezing – e.g. asthma, COPD;
- Snoring rales – e.g. pneumonia, bronchitis, pulmonary edema.

Respiratory system diseases often pose a threat to human health or life. They can lead to progressive hypoxia and death. Such patients usually require urgent medical intervention, preferably in pre-hospital settings [9, 10].

In EMS, initial assessment and treatment is usually implemented by paramedics. In the course of their studies, paramedic students practice respiratory auscultation mainly on mannequins and/or simulators, which are now built to provide high-fidelity experiences and promote a higher level of training.

However, when using mannequins, students are not able to fully portray human tissues and build of the body. Also, during their practical rotations taking care of patients, students are not always allowed to examine a patient multiple times, making it impossible to standardize the level of teaching. A modern method for learning are classes using cadavers, i.e. human unfixed preparations. After a person dies, he/she can declare a willingness to donate their body to research, deeply frozen, and then before the tests are thawed. Donated bodies are a valuable didactic tool because they enable training of numerous medical activities that can be performed repeatedly by a group of students. There is a lot of evidence in the literature indicating students are able to better mastery the ability to perform various medical procedures training on cadavers [11, 12, 13].

The aim of the study was to assess the effectiveness of lung auscultation (apices and basics) by medical rescue students on cadavers. In addition, the authors try to indicate the key advantages of conducting classes on human cadavers rather than training phantoms.

MATERIAL AND METHODS

The study was conducted in October 2018 and involved 27 students of Emergency Medical Services from the University of Natural Sciences and Humanities in Siedlce.

The research tools were cadavers, which were prepared immediately after death, tested for the presence of HBV, HCB, HIV and syphilis, and then frozen. The test results were negative and, therefore safe for the students. The day before the beginning of the study, they were thawed and properly prepared by performing intratracheal intubation and the introduction of fluid into the pleural cavity on the left side to cause auscultation changes. The students' task was to auscultate the lungs (apices and bases) using a stethoscope and to diagnose lungs sounds. At the end of the study, students were asked to assess their own satisfaction from participation in the study on a scale from 1 to 5.

The study was approved by the bioethics commission (No. 11/2018), and the funds were obtained from the project No. 37 titled "The Best of the Best 3.0" of the Ministry of Science and Higher Education.



Figure 1. Auscultate the lungs using a stethoscope.

RESULTS

Twenty-seven (27) EMS students participated in the study, including 11 women and 16 men. The average age was 21.76 (SD \pm 3.20). Two weeks before the study, students took part in classes auscultating lungs in the simulation laboratory. After that an exam was conducted and each participant received an evaluation (100% of students recognized simulated sounds). A homogeneous level of knowledge and skills was found in the whole group. On the cadavers, students auscultated four pulmonary fields - apices and bases, using a stethoscope. Afterwards they had to determine which lung sound they perceive in each of them. The correct murmurs were:

- right lung - alveolar at the apex and base;
- left lung - quiet at the apex, no sound at the base.

The average results of auscultation by a student was:

- Right lung at the apex - 59.26% (SD \pm 49.14);
- Right lung at the base - 96.30% (SD \pm 18.89);
- Left lung at the apex - 40.74% (SD \pm 49.14);
- Left lung at the base - 77.78% (SD \pm 41.57).

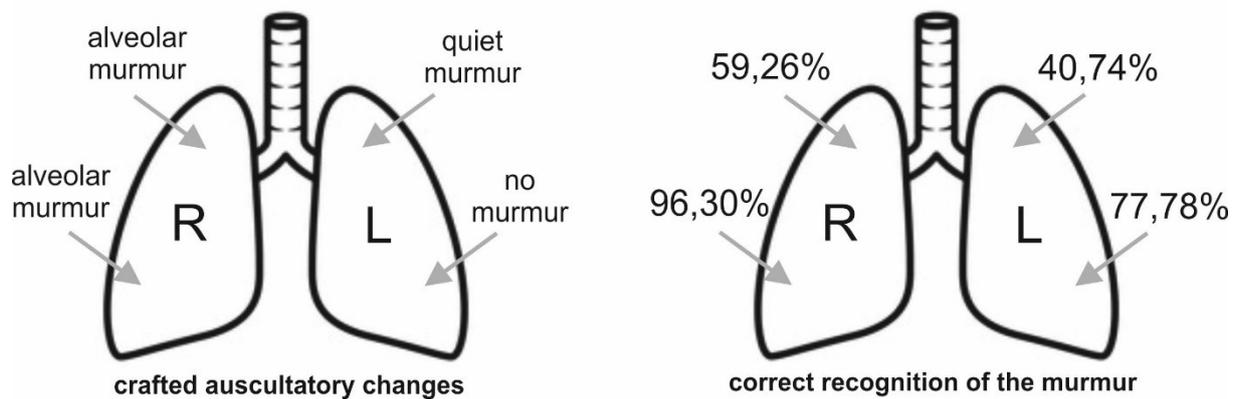


Figure 2. Simulated lung sounds and average result of normal auscultation.

After finishing the study, students filled out surveys regarding their satisfaction with participation in the exercises on a scale from 1 to 5. The average satisfaction level score was 4.37 points (SD \pm 1.13).

DISCUSSION

The high level of knowledge and skills required to perform medical procedures is very important among people working in medical emergency teams. The health and even the life of the victim often depends on them. Respiratory system diseases are a serious risk for patients and can lead to deepening hypoxia and cardiac arrest. In this situation, it is very important to make an appropriate diagnosis based on a subjective and objective examination, and then to implement the appropriate treatment.

During the exercises in the simulation laboratories, students usually use training mannequins, which are not able to fully portray the human body, and thus limit didactic abilities. In addition, they are unable to simulate the behavior of a patient who is in a state of hypoxia. The level of advancement of mannequins is increasing along with their price. That means not every university has the opportunity to provide students with the latest devices, which on the other hand, creates gaps in education. Nowadays, the human body is an increasingly desirable teaching tool. They allow students to practice a wide variety of medical interventions that can be performed repeatedly. There are studies that indicate a higher realism of undertaking medical activities and a high level of satisfaction among people taking part in activities using human cadavers [14, 15, 16].

This study attempted to evaluate the effectiveness of lung auscultation by EMS students. The human cadaver was prepared accordingly before the examination. Students were asked to auscultate four pulmonary fields - apices and basics, stating what lung sound they hear in each of them. Despite the classes that the students had before the test using simulation mannequins, the results were not satisfactory. When using the human cadavers, students received a high average in auscultation of the base of the right lung of 96.30% (SD \pm 18.89). In contrast, when the remaining pulmonary fields were assessed using the cadaver, the results were not as good. The overall results raise doubts about the proper teaching tool for auscultating lung sounds. Our results also show a high risk of poor diagnosis and the potential implementation of inappropriate treatment. However, students showed a high average level of satisfaction with the opportunity to participate in classes.

CONCLUSIONS

The study shows that conducting classes using mannequins in simulation laboratories is insufficient in terms of preparing EMS students for effective auscultation of pulmonary fields. Mannequins do not seem to provide sufficient opportunities to master the practical implementation of some medical tests at the optimal level. Practice on human cadavers could be useful in providing optimal assessment skills. Students who took part in the study showed a high level of satisfaction with participation in classes on human corpses. In order to improve the quality of students' education and practical skills periodic classes on the cadavers should be conducted.

Disclosure statement

The authors did not report any potential conflict of interest.

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