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Skill of localisation of the cricothyroid membrane by students of emergency medicine– an experiment with cadavers.

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ABSTRACT

INTRODUCTION: Patients develop different types of respiratory diseases and conditions which require opening of the airways with instrumentation. If endotracheal intubation for emergency oxygen supply is impossible, the Orly remaining way is conicopuncture. The study aimed to assess the skill of localisation of the cricothyroid membrane by students of medical rescue.

MATERIAL AND METHODS: 27 students of medical rescue at a University in Poland were enrolled in the study. The inclusion criteria were to pass an exam conducted on dummies. A head-and-neck preparation was the research tool: the students were to locate the cricothyroid membrane on it. The Delphi method was employed and a statistical analysis was carried out on figures.

RESULTS: The study enrolled 9 women and 18 men. The mean age was 22.15 (SD±1.53). Only 13 students localised the cricothyroid membrane correctly (48.15%). The students showed a high level of satisfaction from participation in classes (4.81 points in the five-point Likert scale).

CONCLUSIONS: The study showed that classes with dummies do not prepare students sufficiently for correct location of the cricothyroid membrane, which may lead to inability to perform conicopuncture to save lives. Implementation of classes with aid of cadavers in the curriculum of the medical rescue study programme must be considered.

KEY WORDS: Cricothyroid membrane, cadavers, education, science.

INTRODUCTION

Both in the pre-hospital and hospital setting, there might be patients with many different diseases, for instance respiratory conditions such as: Chronic obstructive pulmonary disease, pulmonary oedema, asthma and other [1-3]. Respiratory diseases can pose threat for human health and life. Disease exacerbation leads to progressive systemic hypoxia, which may lead to death. Such a situation warrants oxygen supply through an oxygen mask and commencement of proper pharmacotherapy as quickly as possible. If the larynx becomes oedematous due to anaphylactic shock or burn, the upper airways are becoming progressively obstructed, which may call for endotracheal intubation. However, this is not always possible as oedema of the upper airways or trauma may lead to total closure of the laryngeal lumen/inability to use a laryngoscope, which requires immediate conicopuncture [4-6] – a procedure involving puncturing the cricothyroid ligament to obtain direct access to the trachea. It is performed using preassembled kits, e.g. Quick Trach. Procedures for opening the airways to allow oxygen supply with different techniques, including intubation, can be performed by medical response teams in the out-of-hospital setting in some countries[7,8]. To perform conicopuncture, the medical professional needs to be able to locate the cricothyroid membrane, which requires proper training and competence [9,10].

During the studies, medical students practice performing different medical activities on dummies. Even though they are becoming more and more specialised, they are still unable to reproduce human body structures realistically, which may affect the effectiveness of medical activities performed on living patients. Clinical practice also does not allow education of all students at the same level in this respect as it is frequently impossible to repeat medical activities on one patient because of their condition. However, this can be done on unpreserved human body preparations, namely cadavers. They come from people who before death agreed for their bodies to be used for research purposes. The corpses of such people are deeply frozen right after death to protect them against decomposition. Subsequently, they are slowly defrosted right before examination. Classes with aid of cadavers are limited by their short time of availability for use after defrosting due to the progressive process of corpse decomposition. However, despite this impediment they are a valuable teaching aid giving a lot of opportunities in the area of classes on performance of medical activities. The available literature shows that cadaver practice lets students obtain better education effects as, in effect, they letter the skill of performing medical procedures better [11-13].

The study aimed to assess the effectiveness of location of the cricothyroid membrane on a human body preparation by students of medical rescue. The authors of the study have also attempted to indicate benefits of classes run with aid of cadavers.

MATERIAL AND METHODS

The proper study was conducted in dissecting rooms in Warsaw (Poland) in 2019. 27 students of medical rescue at the Siedlce University of Natural Sciences and Humanities (Poland) were enrolled in the study.

Before the experiment, all students participated in classes with aid of dummies, during which they were shown where the cricothyroid membrane is placed and how to locate it. Subsequently, after the class an exam was held which was passed by all students. The teacher supervising the exam assessed whether the procedure was performed correctly in the simulation setting (on a dummy).

Human corpses (cadavers) – were used as the teaching tool in the study. All preparations had been tested negative for HBV, HCV, HIV and syphilis, so they were safe for the study participants. Having defrosted the head preparations and familiarised the participants with their task – location of the cricothyroid membrane, the participants' work was assessed. To obtain reliable assessment during the exam on cadavers, the Delphi method was employed, which is based on the experience and opinions of experts in the given field. The experts were selected from among the academic teachers with at least 5 years of experience in teaching medical rescue in Poland. The exam station allowed each student to perform the task independently (Fig. 1). No time limitations were imposed on the task.



Figure 1. Exam station with unpreserved human body preparations.

After the task, all students were asked to complete a questionnaire about their satisfaction from participation in the exam conducted on human body preparations by means of the five-point Likert scale. The study was confirmed by the bioethics committee (no. 11/2018) and the funds were obtained from project no. 37 entitled "The Best of The Best 3.0" of the Ministry of Science and Higher Education. The results were presented as figures with standard deviation. The Shapiro–Wilk test and the Wilcoxon signed-rank test were performed. All results were regarded as statistically significant at $p < 0.05$.

RESULTS

The study was conducted for 27 students of medical rescue including 9 women and 18 men. The mean age was 22.15 (SD \pm 1.53). Before the study (14 days earlier), all of them participated in the classes in the simulation setting. Subsequently, the exam was conducted, which was passed by all of the participants and which demonstrated a uniform level of their knowledge.

The students were tasked to find and indicate the location of the cricothyroid membrane on a head-and-neck preparation. The membrane was located correctly by 48.15% of the students (SD \pm 49.97), which means a positive result in 13 out of 27 of them. The distribution of variables regarding the cadaver exam results was not proven normal (Shapiro–Wilk test; $p < 0.000$). The Wilcoxon test demonstrated statistically significant differences between the results of the dummy exam and the actual human tissue exam ($p < 0.000$). At the end of the study, all students completed a questionnaire about their satisfaction from participation in the class on a scale from 1 to 5. The mean satisfaction level was 4.81 points (SD \pm 0.47).

DISCUSSION

Medical response team members should demonstrate strong skills of performing medical rescue activities as their deficit may result in actual threat to patients' health and life. In a situation warranting emergency opening of the airways with instrumentation, for instance by endotracheal intubation, the skills of the medical rescuer become an essential factor. However, if the procedure proves impossible, the only solution that can save the victim's life is conicopuncture.

University students frequently use different types of dummies in class. Even though they are becoming more and more similar to the structure of the human body, they still do not resemble it fully, which limits their teaching potential. Moreover, not every university can afford a specialised dummy for education of their students, which may lead to an uneven level of education depending on the equipment available in the given facility. The available literature includes numerous reports on benefits of classes with aid of cadavers [14-16].

Even though before the experiment the students took part in classes which aimed to teach them how to locate the cricothyroid membrane correctly (100% of the students passed the exam), only 13 out of 27 was able to locate it on a head preparation. This gave a positive result in just under a half of the participants (48.15%). The result may evoke concerns about the skill of locating the cricothyroid membrane by students and, in turn, correctly performing conicopuncture, which may be the only chance of saving a victim's life.

However, the students demonstrated a high level of satisfaction from the possibility to participate in classes with aid of unpreserved human body preparations, giving the mean result of 4.81. (SD \pm 0.47).

CONCLUSIONS

The study showed that holding classes with dummies only is not sufficient for teaching students how to locate the cricothyroid membrane to perform conicopuncture. The students demonstrated a high level of satisfaction from the possibility to participate in classes with aid of cadavers. Solutions needs to be sought that would allow students to participate in classes with aid of human corpses for raising the quality of their education.

SUPPLEMENTARY INFORMATION

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Institutional Review Statement: The study was conducted according to the guidelines of the Declaration of Helsinki.

Informed Consent Statement: Informed consent was obtained from all subjects involved in the study.

Data Availability Statement: The datasets generated and analyzed during the current study are available from the corresponding author on reasonable request.

Conflicts of Interest: The authors declare no conflicts of interest.

REFERENCES

- [1] Hawkins NM, Petrie MC, Jhund PS, Chalmers GW, Dunn FG, McMurray JJ. Heart failure and chronic obstructive pulmonary disease: diagnostic pitfalls and epidemiology. *European journal of heart failure*. 2009; 11(2): 130-139.
doi: <https://doi.org/10.1093/eurjhf/hfn013>
- [2] Crane SD. Epidemiology, treatment and outcome of acidotic, acute, cardiogenic pulmonary oedema presenting to an emergency department. *European J Emerg Med*. 2002; 9(4): 320-324.
doi: <https://doi.org/10.1097/00063110-200212000-00005>
- [3] Subbarao P, Mandhane PJ, Sears MR. Asthma: epidemiology, etiology and risk factors. *Cmaj*. 2009; 181(9): E181-E190.
doi: <https://doi.org/10.1503/cmaj.080612>
- [4] McGill J, Clinton JE, Ruiz E. Cricothyrotomy in the emergency department. *Annals Emerg Med*. 1982; 11(7): 361-364.
doi: [https://doi.org/10.1016/S0196-0644\(82\)80362-4](https://doi.org/10.1016/S0196-0644(82)80362-4)
- [5] Erlandson MJ, Clinton JE, Ruiz E, Cohen J. Cricothyrotomy in the emergency department revisited. *J Emerg Med*. 1989; 7(2): 115-118.
doi: [https://doi.org/10.1016/0736-4679\(89\)90254-0](https://doi.org/10.1016/0736-4679(89)90254-0)
- [6] Hawkins ML, Shapiro MB, Cue JI, Wiggins SS. Emergency cricothyrotomy: a reassessment. *The Amer Surg*. 1995; 61(1): 52-55.
- [7] Klepacka M, Sholokhova D, Bakalarski P, Kupiński K, Leszczyński PK. The profession of a paramedic as a new specialty in the healthcare system - a prospective assessment of socialawareness. *Critic Care Innov*. 2018; 1(2):11-19.
doi: <https://doi.org/10.32114/CCI.2018.1.2.11.19>
- [8] Klepacka M, Bakalarski P. Trust of society towards selected medical professions - doctors, nurses, paramedics. *Critic Care Innov*. 2018; 1(2):1-10.
doi: <https://doi.org/10.32114/CCI.2018.1.2.1.10>
- [9] Leszczyński P, Charuta A, Kołodziejczak B, Roszak M. Evaluation of virtual environment as a form of interactive resuscitation exam. *J New Rev Hyper Multi*. 2017; 23(4): 265-276.
doi: <https://doi.org/10.1080/13614568.2017.1421717>

- [10] Boczkowska K, Bakalarski P, Sviatoslav M, Leszczyński PK. The importance of e-learning in professional improvement of emergency nurses. *Critic Care Innov.* 2018; 1(1):16-24.
doi: <https://doi.org/10.32114/CCI.2018.1.1.16.24>
- [11] Tabas JA, Rosenson J, Price DD, Rohde D, Baird CH, Dhillon N. A comprehensive, unembalmed cadaver-based course in advanced emergency procedures for medical students. *Acad Emerg Med.* 2005; 12(8): 782-785.
doi: <https://doi.org/10.1197/j.aem.2005.04.004>
- [12] Breitmeier D, Schulz Y, Wilke N, Albrecht K, Haeseler G, et al. Cricothyroidotomy training on cadavers-experiences in the education of medical students, anaesthetists, and emergency physicians. *Anesthesiologie, Intensivmedizin, Notfallmedizin, Schmerztherapie: AINS.* 2004; 39(2): 94-100.
doi: <https://doi.org/10.1055/s-2004-817678>
- [13] Leszczyński P, Klepacka M, Bakalarski P, Załęska-Marniche S, Krusińska K, Bojko I, et al. Stopping hemorrhages from the limbs: raising efficiency through training on unfixed human preparations. *Med. Scien Pulse,* 2019; 13(4): 23-26.
doi: <https://doi.org/10.5604/01.3001.0013.6459>
- [14] Yang JH, Kim YM, Chung HS, Cho J, Lee HM, Kang GH. et al. Comparison of four manikins and fresh frozen cadaver models for direct laryngoscopy tracheal intubation training. *Emerg Med J.* 2010; 27(1): 13-16.
doi: <https://doi.org/10.1136/emj.2008.066456>
- [15] Ocel JJ, Natt N, Tiegs RD, Arora AS. Formal procedural skills training using a fresh frozen cadaver model: a pilot study. *Clinical Anatomy.* 2006; 19(2): 142-146.
doi: <https://doi.org/10.1002/ca.20166>
- [16] Leszczyński P, Muraczyńska B, Wejnarski A, Baczewska B, Malm M, Drop B. Improving the quality of training paramedics by means of cadavers—a pilot study. *BMC med edu.* 2021; 21(1): 1-8.
doi: <https://doi.org/10.1186/s12909-021-02498-x>