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Education

IMPROVED AUSCULTATION SKILLS IN PARAMEDIC STUDENTS USING A MODIFIED STETHOSCOPE

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☐ **Abstract—Background: The Ventriloscope® (Lecat's SimplySim, Tallmadge, OH) is a modified stethoscope used as a simulation training device for auscultation. Objective: To test the effectiveness of the Ventriloscope as a training device in teaching heart and lung auscultatory findings to paramedic students. Methods: A prospective, single-hospital study conducted in a paramedic-teaching program. The standard teaching group learned heart and lung sounds via audiocassette recordings and lecture, whereas the intervention group utilized the modified stethoscope in conjunction with patient volunteers. Study subjects took a pre-test, post-test, and a follow-up test to measure recognition of heart and lung sounds. Results: The intervention group included 22 paramedic students and the standard group included 18 paramedic students. Pre-test scores did not differ using two-sample *t*-tests (standard group: $t\ [16] = -1.63$, $p = 0.12$) and (intervention group: $t\ [20] = -1.17$, $p = 0.26$). Improvement in pre-test to post-test scores was noted within each group (standard: $t\ [17] = 2.43$, $p = 0.03$; intervention: $t\ [21] = 4.81$, $p < 0.0001$). Follow-up scores for the standard group were not different from pre-test scores of 16.06 ($t\ [17] = 0.94$, $p = 0.36$). However, follow-up scores for the intervention group significantly improved from their respective pre-test score of 16.05 ($t\ [21] = 2.63$, $p = 0.02$). Conclusion: Simulation training using a modified stethoscope in conjunction with standardized patients allows for realistic learning of heart and lung sounds. This technique of simulation training achieved proficiency and better retention of heart and lung sounds in a safe teaching environment.** © 2012 Elsevier Inc.

☐ **Keywords—auscultation; paramedic; prehospital; modified stethoscope**

Dr. Lecat discloses a financial interest in the Ventriloscope. He only participated in the conception of the study design, and writing the manuscript introduction and background. He was not involved in teaching or testing the students or with grading, interpreting, or writing the results portion of the study.

INTRODUCTION

Increasing emphasis on modern technology has led to the decline in the ability of health care professionals to recognize abnormal heart and lung sounds. However, the stethoscope remains a cost-effective diagnostic tool in the clinical evaluation and identification of abnormal heart and lung sounds in patients (1–3). Current standardized auscultation training for physicians has proven to be an ineffective way to improve most physicians' ability to distinguish abnormal heart, lung, abdominal, and vascular pathologies (4). Previous studies have demonstrated poor auscultation skills in physicians regardless of training level, medical specialty, or country of training (5–13). A nationwide investigation that tested students' auscultation skills on 12 pre-recorded heart

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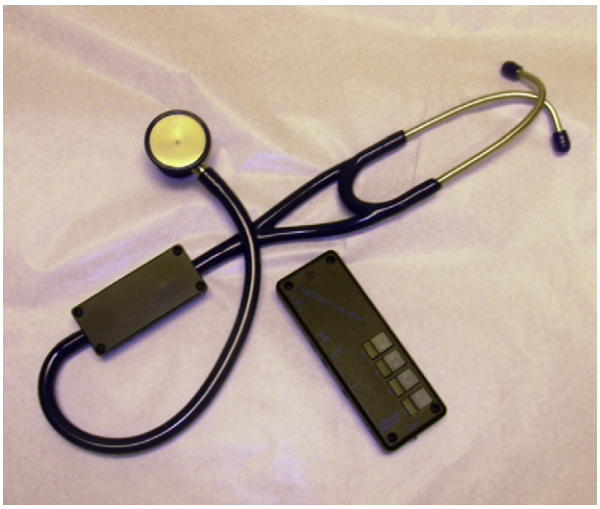

Figure 1. The Ventriloscope® (Lecat's Simply Sim, Tallmadge, OH) is a modified stethoscope that is used as a training device for heart, lung, abdominal, and vascular auscultation. It has two units, consisting of a transmitter that simulates and sends bio-audio information wirelessly through FM radio frequency signals to a receiver that is housed at the base of the (training stethoscope) Ventriloscope. Included with the Ventriloscope is a Secure Digital (SD) flash card that contains 12 common auscultatory sounds on MP3 files, which may be used to execute 10-plus frequently occurring clinical scenarios. Additional auscultation sounds may be demonstrated on the Ventriloscope by simply changing out the SD flash card with other MP3-formatted sound files. For added versatility, an additional input jack enables other pieces of equipment such as a personal digital assistant, compact disk player, desktop or laptop computer, etc., which could supply the transmitted sounds. The maximum transmission range of the signal is approximately 20 feet. An output jack allows for the sounds to be relayed through earphones for verification during an examination by an instructor or to be broadcasted over speakers for use in a group-learning atmosphere [Marcus FI. The lost art of auscultation. Arch Intern Med 1999;159:2396 (18)].

sounds found that the recognition of heart sounds did not improve with lecture-based teaching over 9 months. The median rate of identification of 12 cardiac sounds was only 20% for medical students, 19% for medical residents, and 22% for cardiology fellows (14).

Paramedics are typically the first medical professionals to respond to emergency situations. A previous study demonstrated that paramedic students from two programs did not interpret common lung sounds accurately (15). However, it is critical that paramedics are proficient in the recognition of heart and lung sound anomalies, as well as communicating patients' pertinent information and physical examination findings to the hospital serving as medical control. Increasing paramedic proficiency in recognizing auscultation abnormalities may potentially improve patient outcomes by increasing the speed and accuracy of care.

Currently, at our urban tertiary care teaching hospital, paramedic students receive 1 h of didactic training on heart and lung sounds in the classroom. This is followed by a 2-h laboratory audio session comprised of listening to a cassette tape of heart and lung sounds (C.V. Mosby Company, St. Louis, MO) projected through stereo speakers. Therefore, out of a total of 800 classroom hours in the paramedic-training program, only 3 h are dedicated to learning heart, lung, abdominal, and vascular sounds. Students gain additional exposure through a minimum of 100 patient encounters. The paramedic curriculum meets the requirements mandated by the National Highway Traffic Safety Administration, the governing body for paramedic certification.

Unfortunately, both contemporary methods of training and advancements in stethoscopes have not been effective in achieving an appropriate level of auscultation skills (15). Even advanced stethoscopes have resulted in heart auscultation findings that produce low concordance when compared to echocardiogram findings, as well as exhibiting a high magnitude of disagreement among individuals listening to the same auscultatory sounds (16). This discrepancy in the interpretation of different auscultatory sounds by medical professionals is alarming and not conducive to producing accurate diagnoses or making subsequent medical decisions. Medical educators are appealing to expand auscultation training to increase the skill levels of practitioners, reiterating the need for change in current methods of auscultation training for all medical professionals (17).

When considering the need for improvement in auscultation skills, a simple yet realistic system is needed to advance the skill level of paramedics and other medical professionals. The Ventriloscope® (Lecat's SimplySim, Tallmadge, OH) is a modified stethoscope that has been employed as a training device for auscultation in our institution (Figure 1) (18). Castilano et al. have previously described the Ventriloscope as the first low-cost simulation device to broadcast abnormal findings in a realistic manner (19). The device includes two components: 1) a small handheld FM radio transmitter and 2) a receiver housed in the modified real stethoscope. Pre-selected medically relevant auditory sounds may be sent from the wireless transmitter to the receiver so that they seem to originate from the stethoscope head. The primary objective of this study was to test the use of the modified stethoscope with standardized patient scenarios as a training method to teach the recognition of auscultatory findings to paramedic students. Secondary aims evaluated the feasibility of incorporating simulation training using the modified stethoscope into the paramedic curriculum.

METHODS

Study Design

This was a prospective, single-hospital study conducted in the paramedic-teaching program at a Northeastern