

## APPLICATION OF MEDICAL SIMULATION IN EMERGENCY PRACTICE AND TRAINING OF NERVE AGENT POISONING MANAGEMENT - AN INITIAL WORKS WITH ISTAN SYSTEM

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### SUMMARY

**Objectives:** To compare medical students' satisfaction on two practical teaching methods of neurotoxin: One using simulation technology, the other using laboratory animals. **Subjects:** iStan patient simulation system (Simulation Center, Vietnam Military Medical University - VMMU) and 93 fifth-year students at VMMU. **Methods:** A prospective study was conducted to build scenarios of neurotoxin poisoning in iStan patient at mild, moderate and severe levels, and to propose measures to handle these poisoning situations. Students were provided with lectures through laboratory animals, learners' feedback was given through a set of questionnaires. The scenarios of nerve agent poisoning in iStan patient at mild, moderate and severe levels were also built. On that basis, the iStan system was programmed in order to display clinical symptoms of nerve agent poisoning and level of response to these emergency operations. **Conclusions:** The satisfaction of participants in the simulation method ( $4.37 \pm 1.04$ ) was higher compared to the traditional method ( $3.53 \pm 0.939$ ), with  $p < 0.001$ . The research was initially conducted on the trainees who had lessons on neurotoxin practice from both methods which reveals that using medical simulation technology brings better efficiency in training skills and attitudes of emergency management among students.

\* *Keywords:* Nerve agent; Simulation technology; iStan patient.

### INTRODUCTION

Practice is a teaching method that play a very important role in medicine in general and military toxicology in particular. Nowadays, all of the universities in Vietnam, however, do not currently permit using human experimentation in order to illustrate situations, symptoms and emergency management of poisoning in toxicological

practicing lectures, especially in military toxicology. Laboratory animals are used instead. In terms of the biology, however, there are many differences between experimental animals and human being. Therefore, learners cannot immediately apply the knowledge and skills gained from practicing lectures by using an experimental animal in order to apply for humans.

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Application of simulation in medical training is a trend and indispensable way of medical universities in the world and in Vietnam as well as at Vietnam Military Medical University. Currently, the Medical Simulation Center, Vietnam Military Medical University has equipped iStan simulator patient. This is an open system, which can program more new situations such as poisoning of military toxins. This will meet partly the requirements of practical teaching of military toxicology. Besides, the requirements of system programming, upgrades on equipment hardware and lesson organization should also be carried out to create a favorable practice environment and model that are close to toxic situation in human, especially military poison in the war conditions. In order to apply medical simulation technology for practical teaching in military toxicology, we conducted this study aiming: *To compare medical students' satisfaction on two practical teaching methods of neurotoxin: One using simulation technology, the other using laboratory animals.*

## SUBJECTS AND METHODS

### 1. Subjects

The iStan patient simulation system manufactured and provided by CAE Healthcare is available at the Simulation Center, Vietnam Military Medical University.

93 fifth-year students of Vietnam Military Medical University who have just finished the practice lesson on poisoning and emergency of neurotoxicity that use traditional teaching methods on animals, and then initially get access to iStan medical simulation system.

### 2. Methods

Building scenarios of nerve agent poisoning in humans at severe, moderate and mild levels, that are described in specialized textbooks [1, 8]; programming patient's iStan simulation system follow the manufacturer's instructions [5]; Providing students with lectures through laboratory animals; Receiving learners' feedback through a set of questionnaires for both traditional method and simulation teaching method. Evaluate the students' satisfaction through a 20-question survey according to the scale from 1 - 5 points as follows:

- Very satisfied: 5 points.
- Satisfied: 4 points.
- Not really satisfied: 3 points.
- Dissatisfied: 2 points.
- Very dissatisfied: 1 point.

Evaluation question groups:

- The ability to observe signs of intoxication and the progress of emergency and treatment of intoxication.
- Technical work of the experiment.
- Organization of the experiment.
- General assessment.
- Conclusion: The levels of satisfaction with both these methods.

## RESULTS AND DISCUSSION

### 1. Programming and control iStan simulation patient system

Application of simulation into medical education is the latest trend of medical universities in the world and in Vietnam as well as at Vietnam Military Medical University. That raises the questions when and which aspects of medical lessons this technology should be applied during the training in the university.

Military toxicology is a specific subject related to poison which is taught for fifth year students who have accumulated adequate knowledge and is also consistent with the learner's cognitive logic.

Currently, Medical Simulation Center, Vietnam Military Medical University has equipped iStan simulation patient system used as a tool of teaching 5 clinical emergency techniques. Moreover, thanks to flexible simulation model, technician can program new situations such as poisoning of military toxins, which meets partly the requirements of practical teaching of military toxicology.

The project has built a scenario of nerve agent poisoning of iStan patient at severe, moderate and mild levels. On that basis, it has been programmed on the iStan patient system for symptoms of nerve agent poisoning at different levels (mild, moderate and severe). At the same time, the study has built up different

scenarios in order to handle these poisoning cases.

The system is programmed to record the entire process of the poisoning and response levels on iStan patient with emergency management measures. Students can practise examining and detect intoxication symptoms in iStan patient (stimulation, muscle vibration, convulsions, miosis, increased excretion of glands) and changes in vital functions: ECG, pulse, blood pressure, oxygen saturation, breathing rate that is displayed on computer monitor connected to iStan patients. After then, participants assess the level of intoxication of iStan patient and recommend treatment for this patient.

On the other hand, these data allow students to review and teachers analyze about the whole process of iStan patients' progress from the beginning of intoxication until the end of the management process (figure 1 and figure 2).



Figure 1: Screen controls and monitor survival parameters of simulated patient in the process of emergency practice.



Figure 2: Practice of emergency for patients with poisoned nerve agent.

## 2. Medical students' evaluation of both methods

Table 1: The ability to observe signs of intoxication and the progress of emergencies and treatment of intoxication.

Question content	Traditional method	Simulation method	p
	$\bar{X} \pm SD$	$\bar{X} \pm SD$	
Observing signs of irritation and convulsions	4.56 ± 0.650	3.32 ± 1.739	0.00
Observing pupil contraction and pupil response	4.33 ± 0.851	4.24 ± 0.949	0.49
Changing of vascular and blood pressure	3.39 ± 1.422	4.67 ± 0.665	0.01
The variations of respiratory (breathing rate, breathing pattern)	3.72 ± 1.174	4.38 ± 1.062	0.01
Others	3.82 ± 1.151	3.91 ± 1.373	0.60

The changes of pulse, blood pressure and respiration are shown more clearly and more detail in the simulator-based and traditional teaching methods. Traditional teaching method, however, using animal help learners to observe signs of stimulation and convulsions more vividly. There was no difference in students' evaluation in terms of signs of pupils and other manifestations.

*Table 2: Evaluation of technology of the experiment.*

Question content	Traditional method	Simulation method	p
	$\bar{X} \pm SD$	$\bar{X} \pm SD$	
Function of continuous monitoring of real-time machine	3.18 ± 1.375	4.85 ± 0.416	0.01
Function of lesson review after completion of the experiment to learn from experience right away	2.42 ± 1.696	4.82 ± 0.441	
Function of play/pause so that there is discussion between instructors and learners	1.85 ± 1.725	4.87 ± 0.423	0.00
Levels of response of drugs (different from the theory)	2.01 ± 1.716	4.77 ± 0.610	
Function of giving learners another chance when they do wrongly	1.46 ± 1.646	4.82 ± 0.589	

All the technical work of the simulation experiments was highly appreciated by the trainees compared to traditional teaching method. This difference was statistically significant with  $p < 0.01$ .

*Table 3: Organization of the experiment.*

Question content	Traditional method	Simulation method	p
	$\bar{X} \pm SD$	$\bar{X} \pm SD$	
Psychological pressure requires to act quickly and accurately in the process of practicing	3.97 ± 1.165	3.51 ± 1.486	0.04
The ability of team work of in case of emergency	2.83 ± 1.324	4.57 ± 0.852	0.00
Ability of the experiment repetition	2.17 ± 1.486	4.81 ± 0.595	
The preparation time is faster, there is more time to do with poisoned subjects	2.45 ± 1.339	4.68 ± 0.710	
Highly costs for drugs and consumables used in the experiment (excluding the initial investment cost for equipment)	3.18 ± 1.467	3.46 ± 1.941	0.38

Psychological pressure on learners in the course of experiments by traditional teaching was higher than simulation method, the difference was statistically significant with  $p < 0.05$ . However, the advantages of team work, experiments repetition, and preparation time of the experiment of the simulation method outweighed drawback, with  $p < 0.01$ . The cost of medicine and consumables in both methods were similarly assessed by the participants.

*Table 4: General assessment of satisfactory levels.*

Question content	Traditional method	Simulation method	p
	$\bar{X} \pm SD$	$\bar{X} \pm SD$	
Overall evaluation			
Feeling more real to people	2.97 ± 1.485	3.87 ± 1.454	0.00
Occur similarly over the period of practice and in accordance with theory	3.09 ± 1.231	4.29 ± 1.138	
More opportunities to do practice	2.33 ± 1.394	4.61 ± 0.873	
Gaining better understanding of lessons both in theory and in practice	3.69 ± 1.207	4.51 ± 0.963	
Creating excitement for learning practice	3.62 ± 1.179	4.47 ± 0.996	
Levels of satisfaction	3.53 ± 0.939	4.37 ± 1.040	

Regarding the overall evaluation of two teaching methods among the learner: the average score of the simulated teaching method was higher than that of the traditional one, with  $p < 0.01$  at all comparative indicators.

Finally, assessment of students' satisfaction level in the simulation method was higher than the traditional method (average score of 4.37 and 3.53, respectively).

### CONCLUSION

The research has programmed to control iStan simulated "patient"; create symptoms of nerve agent poisoning at severe, moderate, mild levels and responses accordance with the emergency measures, including correct and wrong treatment of practitioners. The research was initially conducted on the trainees who had lessons on neurotoxin practice from both methods which reveals that using medical simulation technology brings better

efficiency in training skills and attitudes of emergency management among students.

### RECOMMENDATION

From the above-mentioned results, we recommend the high-level agencies to expand further research with other military toxins and to propose comprehensive solutions on equipment infrastructure, classroom organization in order to officially introduce a medical simulation method into teaching military toxicology

practice at Vietnam Military Medical University.

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