INTEGRATION OF SIMULATION IN THE EDUCATIONAL PROGRAM OF TRAINING RESIDENTS IN LEBANON

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Abstract

Background: All caregivers should be prepared for all the situations they will meet during their professional practice, whether it's a simple everyday situation or rare and complex one.

Simulation increased safety measures by improving individual practices of actors of the healthcare system, by improving the medico-technical competence and non-technical competence, like care planning and communication.

Methods: A team of university instructors specialized in training on simulator should be involved for the creation and development of the faculty simulation center.

The educational program, the architectural aspect, the simulation techniques as well as the educational team and the targeted population will be developed by the committee of the simulation center, based on clinical and basic requirements of each year of training.

Educational objective is to develop fundamental technical and decision-making skills and competencies culminating progressively during the internship and residency years.

Results: The integration of simulation into the training of interns and residents in anesthesiology program in Lebanon reflects the need for this type of training as well as the expected impact. This program should be extended, obligatory and validated. A gradual learning adapted to each resident physician beyond simply the ability to perform a technical gesture, but also teamwork and leadership.

Conclusion: Simulation based learning is complimentary to classic learning techniques and should be introduced in every training cursus. The only concern is the high cost of developing a simulation center but on long term basis it will be less than the total cost of iatrogenic complications.

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Introduction

"Never the first time with the patient". It's a simple quote that represents the basics of medical simulation.

This citation underlies the fact that all caregivers should be prepared for all the situations they will meet during their professional practice, whether it's a simple everyday situation or rare and complex one. The simulation has thus become inescapable in all areas where the reality is too dangerous, too expensive, difficult to manage, inaccessible or too rare to gain sufficient experience.

In all these areas and specialties, simulation increased safety measures by improving individual practices of actors of the healthcare system, and also by improving non technical skills such as crisis management, communication between individuals, etc…

Simulation allows schematically the improvement of two major aspects of medical competence[1]:

- The medico-technical competence, like performing gestures (catheter placement, surgical procedure...)
- Non-technical competence, like care planning and communication or even learning to lead situations (team work and leadership). In the aeronautical field for example, it is inconceivable not to have a simulator training before starting real flights.

Teaching at the bedside and in the operating room represents the keystone of the formation of residents in anesthesiology. However, several factors contribute nowadays for decreasing teaching hours and process. Among them, we can mention the decrease of the didactic impact of hospital because of their heterogeneity[2], lack of supervision[3] and especially the lack of evaluation of teaching[3] and the appearance of the regulatory compensatory rest which significantly reduces hospital learning period[4].

Several studies indicate that medical students typically do not receive standardized and sufficient hands-on training on advanced procedural skills[5,6]. Among these are intubation, arterial line placement, central line insertion, and lumbar puncture[5]. These are advanced and somewhat invasive procedures, basics of anesthesia practice that can cause discomfort and/or complications for patients.

Almost fifty percent of the residency programs in the United States of America have incorporated simulator-based training into their curriculum[7] so it is time to start this practice in a routine basis in our institution.

The main objective of this article is to develop a pedagogic cursus to anesthesia residents where the simulation is a part of educational and evaluation process.

Material and Methods

1. Conceptual bases of teaching by simulation

Simulation can be defined as an educational process which replaces the practice with real patients by artificial models, actors or virtual patients[8]. Its goal is to recreate scenarios or learnings techniques in a realistic environment, with a dual objective: the immediate experience feedback and the assessment of prior learning.

Medical simulation relies on conceptual bases derived from education sciences. Several models are involved: the Kolb model which details several learning strategies[9], the concept of voluntary practice[10], the concept of adult education[7], and learning in a realistic environment[11].

The main principles governing all these models are:

- Active learning, clearly identified as such by students' motivation, clear learning objectives, appropriate and growing level of difficulty, targeted and repeated activities, taking into account the diversity of students and their previous knowledge, the articulation with basic sciences, realistic environment, and a multidisciplinary approach[10,11,12];
- Simulation techniques also improve

communication skills within multidisciplinary teams (operating room for example)[8]. Their application in medicine is directly derived from the concept of analysis of accidents occurring in different areas like the aeronautical or nuclear industry. A parallelism exists between the problems, their origins and their solutions between medicine and the aeronautical industry[13].

2. Developed methodology for the simulation program

A team of university instructors specialized in training on simulator should be involved for the creation and development of the faculty simulation center.

An architectural and educational project will be developed within the Faculty of Medicine of the university.

The educational program will be developed by the committee of the simulation center, and will be based on clinical and basic requirements of each year of training.

3. Architectural aspect

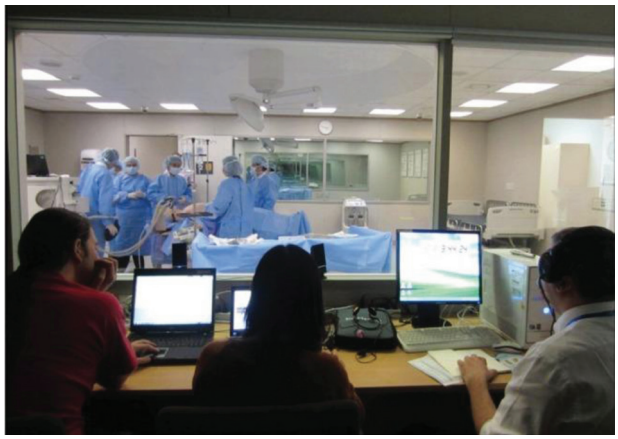
The simulation center of the anesthesiology department of the faculty of Medicine should have three identical rooms. Each one will contain the medical part, a completely reconstituted operating room, provided with all the real medical equipment (allowing a realistic context) chairs, a pedagogic part containing interactive screen, board, audiovisual equipment for debriefing and feedback and a "control" part (piloting the models, recording, broadcasting) Figure 1.

4. Simulation equipment

The choice of the simulation supports should be done after the literature analysis, the technical possibilities of each simulator in order to obtain comparable and reproducible data over the long term.

The supports for the medical simulation are:

Fig. 1



- Supports for simple technical gestures:

  1. Back for spinal anesthesia performance

  2. Hands for intravenous catheter and arterial lines insertions

  3. Neck and trunk for central venous catheter insertion

  4. Intubation heads

  5. Nonanatomic inorganic phantom for ultrasound-guided regional anesthesia. Figure 2

- Two computer manikins "high fidelity" (Simman®, Laerdal®) and one pediatric high fidelity manikin computer-controlled connected to conventional OR equipment.

5. Educational team

The persons responsible for the development of medical curricula will be certified and will receive continuous training in the field of medical simulation.

Seven anesthesiologists practicing will be

Fig. 2

involved in the training of anesthesiology interns and residents. They are specialized in pediatric anesthesia, obstetric anesthesia, loco regional anesthesia, general anesthesia (Three anesthesiologists) and cardiovascular anesthesia.

Each of them will have a detailed training on the use of simulators and their educational implications.

6. Target population

Anesthesiology residents involved in the educational program are:

All four years anesthesia residents.

7. The teaching program by the simulation technique

The simulation curriculum is articulated around three axis:

- A technical learning of the usual technical gestures ranging from simple procedures to more complicated maneuvers.
- Teamwork in the operating theatre
- Multidisciplinary management of acute anesthesiology medical and surgical situations.

Educational objective is to develop fundamental technical and decision-making skills and competencies culminating progressively during the internship and residency years.

Anesthesiology interns

All anesthesia residents will have a nine months internship where they will be rotating in different medical and surgical units before going to the operating room.

During this period, interns will attend three simulation sessions of basic setup (patient monitoring) and anesthesia machine usage and malfunction treatment.

In addition, they will learn at this level some basic technical skills like intravenous catheter insertion, endotracheal intubation and laryngeal mask placement.

These sessions will be introductory to the CA-1 level where more tasks will be asked and learned.

CA-1 level

Curriculum consists of treatment of common urgencies encountered during maintenance of anesthesia such as increased peak airway pressure, increased heart rate, decreased blood pressure and decreased oxygenation.

Our curriculum continues with standard and rapid sequence induction, laryngospasm, and hypovolemic shock scenarios, to develop cognitive and psychomotor skills for the operating room.

Advanced technical skills will be presented in simulation sessions to offer to the residents the possibility of learning these skills in the manikin.

1. Arterial line insertion
2. Central venous catheter insertion
3. Ultrasound guided loco regional anesthesia simulation sessions on non anatomic inorganic phantom.
4. Performing spinal anesthesia.

CA-2 level

Curriculum consists of the difficult airway management, ICU/ward intubation, ACLS/code blue scenario, post-operative respiratory distress, local anesthetic toxicity, anesthesia machine malfunction, anaphylaxis, airway fire, malignant hyperthermia, severe hypotension with high spinal, hypovolemic shock, emergency cesarean section, and other non medical scenarios like breaking bad news.

CA-2 residents are given an opportunity to develop and show a higher level of clinical skills and knowledge of pathophysiology.

We encourage the use of all the available resources of personnel and technical support as well as teamwork.

CA-3 level

The residents are given the opportunity to repeat previously encountered scenarios and are evaluated for clinical competency in the management of different conditions.

Furthermore, since it is the last year of the residency program, they are given an opportunity to be in the lead role and guide junior residents through different scenarios playing the role of an educator/ supervisor.

Residents will experience a half day simulator session, including debriefing, approximately 5 times a year starting the CA-1 level. it will be a part of their Core Teaching program. These sessions will be coordinated with the didactic curriculum the residents are working on at the time.

The simulation session takes place in three stages[14]-briefing, simulation exercise, and de-briefing. During the briefing the leader introduces the clinical exercise and familiarizes the trainees with the manikins and the operation room set up. During the de briefing session, the videotaped exercise is shown to the candidate along with the other team members. The trainee's performance is critically analyzed and constructively criticized[15,16] Table 1.

Additionally, residents will be visiting he simulation lab several other times during their training for specific sessions, such BLS/ACLS/PALS training.

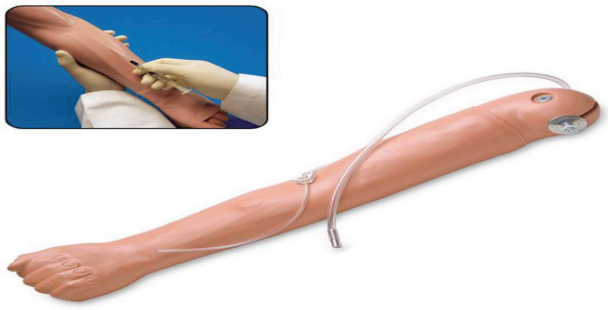
Before every simulation session a baseline skills assessment (pretest) is done, followed by viewing a video and lecture, about the session subject, then a deliberate practice using a simulator. All participants are required to meet or exceed a minimum passing standard (MPS) on a rigorous skills assessment (posttest). The resident who did not meet or exceed the minimum passing standard (MPS) at initial post testing will be required to engage in more deliberate practice and testing until the MPS was reached.

A second reassessment is done six months and one year after the initial training. Residents who did not meet or exceed the MPS on follow-up testing will have further deliberate practice and testing on the simulator until the MPS is achieved. Figure 3.

Table 1

	EXERCICE	SUPPORT	TIMING
CA-1	• Technical skills: arterial line insertion, spinal anesthesia performance, rapid sequence intubations, central venous catheter insertion, ultrasound guided regional anesthesia	• Hands, back, intubation heads, trunk manikins, non anatomic organic phantom	• 3 simulation sessions of half day duration
	• Clinical scenarios: common urgencies like hypotension, Brady or tachycardia, increased airway pressure	• High fidelity manikin(Simman)	• 2 simulation sessions with 2 subjects in each session
CA-2	• Malignant hyperthermia, local anesthesia toxicity, anaphylaxis, obstetrical bleeding, ACLS, high spinal, breaking bad news…	• High fidelity manikin	• 5 simulation sessions per year of half day each with 2 subjects treated in each session.
CA-3	• All clinical scenarios already treated will be reevaluated • Evaluation of leadership and teamwork abilities	• High fidelity mannikins	• Total of 5 simulations per year
INTERNS	• Monitor setup • Anesthesia machine use • Intravenous line insertion • Endotracheal intubation • Laryngeal mask placement	• High fidelity manikin • Anesthesia machine and ventilator • Hands for Intravenous catheter insertion • Intubation heads • Intubation heads	• These tasks will be divided on 3 simulation sessions of 4 hours duration each.

Fig. 3



Discussion

The development of simulation based education is still very poor at the national level as compared to the American educational standards[17]. The integration of simulation into the training of interns and residents in anesthesiology program at the Faculty of Medicine of the American university of Beirut reflects the need for this type of training as well as the expected impact. The development of the educational program is based on a review of recent American and European curriculum literature and the classic pedagogic program already used. The program will be re-evaluated after one year and will be modified according to educational needs. Several principles are retained:

1. Extended, Obligatory, starting the beginning of the residency program, validated by a post test and a MPS.
2. The selection of precise and reproducible validation criteria for the different exercises and simulations. These are either scores or metric criteria depending the type of procedures. These criteria are derived from the literature when they exist or from the average expert performance.
3. A gradual learning adapted to each intern.
4. The integration of concepts beyond simply the ability to perform a technical gesture, specially teamwork and leadership.

Conclusion

This training program is complementary to the classic training program. It builds situations close to the ones seen in the real medical practice at the technical, cognitive and behavioral levels.

This article demonstrates the feasibility of such of a simulation program in an academic medical center. The only concern is the high cost of developing a simulation center but on long term basis the cost of a simulation center (including the simulator, equipment, and faculty time training) will be less than the total cost of iatrogenic complications[18].

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