

Teaching suturing skill to emergency physicians: the experience of a hands-on practical training in a laboratory simulation-based setting

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Abstract

Both specialists and trainees in emergency medicine are often unaware of the principles of good suturing. Hands-on training course was proposed to both members of the staff (group A) and trainees (group B) of the emergency department of our hospital. Familiarity with all aspects of the operation, pre-course 0%, post-course 79% (group A) and 85.71% (group B) - $p < 0.000$; clear economy of movement and maximum efficiency, pre-course 0%, post-course 73.8% (group A) and 89.80% (group B) - $p < 0.000$; fluid moves with instruments and no awkwardness, pre-course 0%, post-course 73.8% (group A) and 89.80% (group B) - $p < 0.000$; obviously planned course of operation with effortless flow from one move to the next, pre-course 0%, post-course 79% (group A) and 89.80% (group B) - $p < 0.000$; strategically used assistants to the best advantage of all time, pre-course 0%, post-course 73.8% (group A) and 89.80% (group B) - $p < 0.000$; improvement in dexterity, 79.5% of students post-course). The course was judged very useful by 94.8% of students. Attending suturing skill courses could be very useful for both trainees and specialists in emergency medicine.

Introduction

Traumatic wounds are one of the most common pathologies presenting to the emergency department (ED), thus, achieving expertise in suturing techniques is to be considered a priority for the emergency physician.¹ Nevertheless, basic surgical skills learning opportunities are often insufficient in medical student's education programs.²⁻⁵ Moreover, although in Italy residents in emergency medicine (EM) have to perform not less than 40 sutures of traumatic wounds in their five-year course to obtain certification, dedicated teaching courses are often lacking even in this post-graduate setting.⁶ To make up for the lack of suturing skill acquisition programs at an undergraduate level, simulation-based training has been widely adopted, and this strategy demonstrated widely successful in getting the goal.⁷ The aim of this paper is to describe the results of a hands-on practical training in a laboratory simulation-based setting, proposed to both emergency physicians and residents in EM of a tertiary university hospital.

Materials and Methods

A hands-on practical training in a laboratory simulation-based setting was proposed to both members of the staff of the ED of the Policlinico Gemelli IRCCS and residents of the Postgraduate School of Emergency Medicine of the Università Cattolica del Sacro Cuore of Rome, Italy. The first step of the course was a slide presentation showing the principles of good suturing, *i.e.*, techniques of skin disinfection, principles of local anesthesia, surgical

instruments necessary, types of stitches usually put in the emergency setting, principles of antibiotic and tetanus prophylaxis. This presentation was followed by a video demonstration to make student familiarize with the procedure before starting practical session. Specifically dedicated materials were used, as reported: 1 synthetic silicone pad, 2 non-sterile spools of nylon thread 3/0, 1 needle holder and 1 anatomical forceps for each student. Two members of the ED staff with consolidated past surgical experience act as tutors for the practical training, that was held in 2 sessions of approximately 3 hours each, with 4 students for 1 tutor, at 3-5 months apart from each other (Figure 1). The first session was preceded by a practical demonstration of the technique by the tutors. Between the two sessions, it was recommended that all students improve their practice, both on patients, under the direct control of the tutors, and at home, on silicone pads. Modified Objective Structured Assessment of Technical Skill (OSATS) tool was used by tutors to evaluate students' ability in suturing techniques after practical training, comparing pre- and post-course performances.⁸ This evaluation was carried out separately for employed ED physicians and trainees. At the end of the second session, students' feedback on the level of satisfaction with the course and the effectiveness of the teaching strategy in improving their ability in suturing techniques, was obtained through a questionnaire submitted to both members of the ED staff and residents and evaluated separately in each of the two groups (Table 1). Chi-square test was used to verify the statistical significance of the difference in students' pre- and post-course ability in suturing techniques, according to variation of the items of the modified OSATS score. $p \leq 0.000$ was considered statistically significant.

5 declared to be capable of making sutures, and 4 did not attend the second practical session) (group A). Of the 49 (100%) residents who completed the course, 24 (48.9%) attended the first year of residency, 9 (18.3%) the second and the third respectively, 2 (4%) the fourth and 5 (10.2%) the fifth (group B). Only 2 students in group A and 5 in group B declared some scanty pre-course experience in suturing post-traumatic wounds. The post course improvement in suturing ability was extremely relevant among physicians of the ED staff (Table 2) and even more among residents (Table 3). In particular, if none of the students in either group demonstrated knowledge of all aspects of the operation at the pre-course evaluation 15/19 (79%) students of group A and 42/49 (85.71%) of group B acquired this familiarity after the course ($p < 0.000$). Dramatic technical improvement was also noticed regarding the other items of the modified OSATS tool in both groups. Clear economy of movement and maximum efficiency was not evident in any of the



Figure 1. The suture lab.

Results

The course was attended by 68 students. Of 34 physicians of the ED staff, only 19 (56%) completed the course (6 were not interested because members of the staff exclusively dedicated to the prosecution of cure after the initial treatment of the patient,

Table 1. Satisfaction questionnaire submitted to the students.

Competence of the tutors	A little	Enough	Very	Very much
Do you think that tutors were up to the task assigned ?				
Do you think that tutors dedicated sufficient time ad care to the students?				
Do you think that the teaching strategy adopted made easy to understand the procedure and its purpose?				
Environment and arrangement	A little	Enough	Very	Very much
Do you think that technical device adopted were adequate and performing ?				
Do you think that the location was comfortable and appropriate?				
Do you think that time dedicated to the practical sessions was enough?				
General evaluation	A little	Enough	Very	Very much
Was the course interesting?				
Did you notice an improvement in your dexterity after the course ?				
Do you think that what you learned during the course will be useful for you in your everyday activity as emergency physician?				
Do you think it could be useful and advisable to include this course in the official training programme of the postgraduate school in emergency medicine ? (For trainees only)				
Do you think it could be useful and advisable to include this course in the update programs for the emergency physicians? (For staff members only)				

students before the course but in 73.8% of them after the course in group A and in 89.80% in group B ($p<0.000$). Fluid moves with instruments and no awkwardness was not showed by any of the students at pre-course evaluation in both groups, but in 73.8% of them in group A and in 89.8% in group B after the course ($p<0.000$). Obviously planned course of operation with effortless flow from one move to the next was seen in no student in both groups at pre course evaluation, but evidenced in 79% of them in group A and in 89.8% in group B after the course ($p<0.000$). Finally, no students strategically used assistants to the best advantage

of all time before the course in both groups, while 73.8% of them in group A and 89.8% in group B did it after the course ($p<0.000$). The level of satisfaction with the course was very high among the students (Table 4). All students expressed very much satisfaction with the didactic approach, regarding both competence of tutors (68/68 - 100%) and time and care dedicated to students (68/68-100%), as well as for the teaching strategy adopted (67/68 -98.5%). The course was judged very much interesting by 64 students (94%). A noticeable improvement in dexterity after the course was noticed by 54 students (79.5%) and 64 of them (94.8%)

Table 2. Improvement of technical skill among ED physicians.

Time and motion	Pre-course	Post course	p
Many unnecessary moves	17/19	/	<0.000
Efficient time/motion but some unnecessary moves	2/19	5/19	
Clear economy of movement and maximum efficiency	0	14/19 (73.8%)	
Instrument handling			
Repeatedly makes tentative or awkward moves with instruments by inappropriate use of instruments	17/19	/	<0.000
Competent use of instruments but occasionally appeared stiff or awkward	2/19	6/19	
Fluid moves with instruments and no awkwardness	0	14/19 (73.8%)	
Flow of operation			
Frequently stopped operating and seemed unsure of next move	17/19	/	<0.000
Demonstrated some forward planning with reasonable progression of procedure	2/19	6/19	
Obviously planned course of operation with effortless flow from one move to the next	0	15/19 (79%)	
Use of assistants			
Poorly or failed to use assistants	17/19	/	<0.000
Appropriate use of assistants most of time	2/19	5/19	
Strategically used assistants to the best advantage of all time	0	14/19 (73.8%)	
Knowledge of specific procedure			
Deficient knowledge, needed specific instruction at most steps	17/19	/	<0.000
Know all important steps of operation	2/19	4/19	
Demonstrated familiarity with all aspects of operation	0	15/19 (79%)	

Table 3. Improvement of technical skill among residents.

Time and motion	Pre-course	Post course	p
Many unnecessary moves	42/49	0	<0.000
Efficient time/motion but some unnecessary moves	7/49	5/49	
Clear economy of movement and maximum efficiency	0	44/49 (89.8%)	
Instrument handling			
Repeatedly makes tentative or awkward moves with instruments by inappropriate use of instruments	44/49	0	<0.000
Competent use of instruments but occasionally appeared stiff or awkward	5/49	5/49	
Fluid moves with instruments and no awkwardness	0	44/49 (89.8%)	
Flow of operation			
Frequently stopped operating and seemed unsure of next move	42/49	0	<0.000
Demonstrated some forward planning with reasonable progression of procedure	7/49	5/49	
Obviously planned course of operation with effortless flow from one move to the next	0	44/49 (89.8%)	
Use of assistants			
Poorly or failed to use assistants	39/49	0	<0.000
Appropriate use of assistants most of time	10/49	5/49	
Strategically used assistants to the best advantage of all time	0	44/49 (89.8%)	
Knowledge of specific procedure			
Deficient knowledge, needed specific instruction at most steps	42/49	0	<0.000
Know all important steps of operation	7/49	7/49	
Demonstrated familiarity with all aspects of operation	0	42/49 (85.71%)	

assessed that what learned during the course would be very useful in their future daily activity as emergency physicians. Almost all residents (48/49-98%) thought that could be very much useful to include the course in the official training program of the post-graduate school in EM, and almost all of the physicians of the ED staff (17/19-90%) in a scheduled update program. The environment and arrangement were not completely satisfying. Only 34 of the 68 students (50%) judged the technical devices very much adequate and performing, and only 46/68 (67.5%) considered the location very comfortable and appropriate. Nevertheless, the great majority of students (66/68-97%) considered the time dedicated to practical session very adequate. The total costs for the entire course amounted to 359 euro.

Discussion

Epidemiological data about prevalence and incidence of traumatic wounds in the ED setting are scanty. Van Tiggelen *et al.*⁹ in their study of 2020, reported a skin-tears prevalence (in acute care) ranging from 3.3% to 19.8 %, with wide variability among different countries. To the best of our knowledge, the only data about incidence of traumatic wounds in the ED setting in Europe comes from the recent study of Van Der Baaren *et al.*,¹⁰ who collected data of 342 patients with traumatic wounds who attended the ED of a 2-level Trauma Centre in the Netherlands in period of one-year. More comprehensive, but not recent data, comes from the study by Stussman¹¹ who reported that more than 12 million traumatic wounds are treated each year in the ED in United States. Although, knowing principles of good suturing and acquiring confidence with this basic surgical procedure seem mandatory for the ED physician, no reports are available in literature about the results of suturing skill teaching programs for ED physicians without surgical background, or for post-graduate school in EM residents. The problem of the insufficient surgical education is quite evident also in medical school teaching programs all over the world.¹²⁻¹³ In a recent report about the surgical experience at medical school evaluated by an on-line questionnaire sent to a group of physicians of non-surgical specialties, suturing skill was judged the most important items learned

during surgical training by a large part of them.¹⁴ Nevertheless, although suturing has the steepest learning curve among the basic surgical procedures that each medical student must acquire, teaching this skill requires intensive labor as such as a high teacher to student ratio,¹⁵ and must make the girdle with the decreasing duration of the surgical rotations and the limited time for training in the clinical environments.⁷ As a response to these difficulties, many experiences have been published in the last years about the results of simulation-based training programs aimed to allow medical students to acquire suturing skill.¹⁶⁻²⁹ The recent review by Emmanuel *et al.*⁷ summarizes the results of these studies. Teaching interventions differ in equipment, timing, methods, instructor level and performance assessment. Despite methodological differences, the consensus about positive results in terms of effectiveness in improving medical student confidence in suturing techniques was unanimous.⁷ We also like to stress how the results of this study evidenced that simulated practical training in wound suturing is beneficial at any time point of medical school, and peer-assisted learning could be an effective teaching method, compared to the traditional techniques.⁷ On the base of such good results, we tried to translate this educational strategy into an emergency setting. Since two members of the ED staff have past consolidated surgical experience, we chose an instructor-directed teaching approach, with great satisfaction from all of the students regarding both competence of the tutors and the time and care dedicated to the students. Nevertheless, it is clearly evident from the analysis of the literature on the subject that the use of non-expert instructors, according to a peer-to peer approach, is an effective alternative teaching strategy.^{15-24,30}

The main advantages of this approach are: compensating for the limited availability of surgeons to set aside their clinical roles for education and training, allowing students to develop their skills in a non-intimidating environment and giving senior students the opportunity to further enhance their technical and teaching skills.^{7,31-32} All of the students were particularly satisfied about the structure of the course, which provided two teaching sessions before and after a 3-5 months period dedicated to enhance practice, both on patients, under the direct control of tutors, and at home, on silicone pads. We think that this teaching method could be a good answer to the well-known problem of skill retention as, although single session teach-

Table 4. Results of the satisfaction questionnaire submitted to the students.

	A little	Enough	Very	Very much
Do you think that tutors were up to the task assigned ?				68/68 (100%)
Do you think that tutors dedicated sufficient time ad care to the students?				68/68 (100%)
Do you think that the teaching strategy adopted made easy to understand the procedure and its purpose?			1/68 (1.5%)	67/68 (98.5%)
Environment and arrangement	A little	Enough	Very	Very much
Do you think that technical devices adopted were adequate and performing ?		2/68 (3%)	32/68 (47%)	34/68 (50%)
Do you think that the location was comfortable and appropriate?	2/68 (3%)	4/68 (6%)	16/68 (23.5%)	46/68 (67.5%)
Do you think that time dedicated to the practical sessions was enough?			2/68 (3%)	66/68 (97%)
General evaluation	A little	Enough	Very	Very much
Was the course interesting?			4/68 (6%)	64/68 (94%)
Did you notice an improvement in your dexterity after the course ?			14/68 (20.5%)	54/68 (79.5%)
Do you think that what you learned during the course will be useful for you in your future daily activity as emergency physician?			4/68 (6%)	64/68 (94%)
Do you think it could be useful and advisable to include this course in the official training programme of the postgraduate school in emergency medicine ? (For residents only)			1/49 (2%)	48 /49 (98%)
Do you think it could be useful and advisable to include this course in the update programs for the emergency physicians? (For staff members only)			2/19 (10%)	17/19 (90%)

ing scheme may improve suturing performance in the short-term, it seems not sufficient to maintain suturing proficiency of students over longer period of time.^{10,28,33-34} According to the vast majority of similar teaching experiences reported in literature, we started the course with a slide presentation aimed at showing the principles of good suturing and a video demonstration to make student familiarize with the procedure before starting practical sessions. This teaching strategy was considered very satisfactory by 98.5% of the students.⁷ This result was not surprising as many authors already underlined the fundamental role of videos as an introductory pathway to the learning process of motor skills.^{7,19} As practice material, we chose a 'dry' bench model, *i.e.* single-layer silicone mats, as used in most similar studies, but only 50% of students were satisfied about the equipment's quality. Although this partial satisfaction is reported as a student opinion, in other studies specifically dedicated to the topic, we do not refuse our choice of a "dry" model for didactic purpose, as we believe it represents an excellent alternative to the animal model, due to its easy availability, versatility, ease of storage and favorable cost-effectiveness.³⁵ We choose the OSATS tool, calculated by the two expert instructors, to evaluate students' ability in suturing techniques after practical training, as reported by the majority of the studies.⁷ The results were extremely satisfying in both groups of ED staff members and residents in EM. In particular, we like to stress how, although no students of both groups showed familiarity with all aspects of the operation at pre course evaluation, 15/19 (79%) of ED staff members (group A) and 42/49 (85.7%) of residents (group B) acquired this familiarity after the course, and this difference resulted statistically significant ($p < 0.000$). The students' satisfaction was evidenced by the high level of their self-awareness of consistent improvement in dexterity after the completion of the training program, that was reported by 54 students (79.5%). Moreover, the vast majority of students (64/69 – 94.8%) assessed that what they learnt during the course would be very useful in their future daily activity as emergency physicians. Almost all of the physicians of the ED staff (17/19 – 90%) thought that could be very much useful to include the course in a scheduled update program, and almost all residents (48/49 – 98%) considered very much advisable to improve the official training program of the post-graduate school in EM with a suturing skill training course.

Conclusions

To the best of our knowledge, this is the first study aimed at evaluating the results of a suturing skill acquisition program dedicated to specialist and trainees in EM, with the aim of filling a widespread educational gap. The course was very successful among both ED staff members and trainees and extremely satisfying in terms of self-perceived confidence in suturing technique. Two members of the ED staff with consolidated surgical experience acted as tutors, enabling students to develop their skills in a non-intimidating environment, but this goal can easily be also achieved by entrusting this role giving this role to senior students, according to a peer-to-peer approach. The course resulted low resource consuming, both in terms of budget, 359 euro for materials and no faculty pay as tutors act on a voluntary basis, and time necessary to dedicate to it, as both didactic sessions and practice on patients could be easily integrated with daily activity of both students and tutors. We suggest including this type of course in the official training program of the post-graduate schools in EM and in a scheduled update plan for ED physicians with no surgical background could be advisable.

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